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# AN INTERRUPTED ZENITHAL WORLD MAP

By Arthur Davies

Geographers are continually surprised to find that some commercial atlases do not appear to be based on mathematical projections, and still rely on the mathematically inferior projections of Mercator, Sanson-Flamsteed, Mollweide, and Gall for world maps. There are probably three reasons for this, each of them a sound one in its way: the first is that many graticules which may be mathematically superior are copyright and their use would greatly increase the cost of the atlas. Secondly, it is expensive to arrange computations, etc., of new graticules when the old ones will do and are available ; the mathematician calls this inertia and the business man calls it commonsense. Thirdly, there is no obviously better projection, better suited to present world conditions and free from copyright, which has yet been made available to scientific periodicals, publishers of atlases and scientific works. The Interrupted Zenithal World Map is intended to serve that need.

Readers are reminded that the Mercator projection has enormous exaggeration in high latitudes but can show the whole world east-west with an overlap, its only useful property as a world map. In a sense it preserves true direction and is useful in navigation, but no navigator uses an atlas map. It preserves true shape only for tiny areas of the earth's surface, so that to think of it as true shape for continents and world outline is quite erroneous. The Equal Area graticules of Mollweide and Sanson-Flamsteed preserve true scale along parallels, if that is any use in a world map, but their property of equal-area is not of first importance in a world map. Their distortion of shape, distances, and directions between countries and regions renders them inferior choices for world maps. Their interrupted form improves shape of individual continents at the expense of still further crimes against true distance and direction. Gall's Stereographic, unpopular with mathematicians because it preserves no special mathematical property, avoids much of the imperfections of the others and has been used with advantage in some of our best atlases. Its day is now past, however.

It must be recognised in all fairness that prior to the air age these world projections served reasonably well to display to geographers and the public what was in effect a cylindrical world.[1] The trans-continental railways, the great shipping lines, the ocean cables, these for the most part ran east-west across the world, shaped by accidents of geography. The Mediterranean Sea led to the Persian Gulf and to the Indian Ocean, forming a great east-west shipping route. The midworld mountain belt runs east-west in the midst of the old world, and has shaped the advance of nations and guided routes and railways throughout historic time. The great deserts of the world run east-west, and so do the great tropical and equatorial forests, while the cold pine forest of northern lands extends as an east-west barrier to the 'northward march of civilisation'. Forests and pastures, crops and man stopped short of the Polar Regions, which lay in the shadowy wilderness of the world, for routes never crossed them nor did human thought seek to penetrate them to what lay beyond, on the other side. The earth in terms of human geography was indeed cylindrical; it extended to the Far West and the Far East, but it stopped short of high latitudes. In such a world the traditional world projections sufficed, for their imperfections were most pronounced in high latitudes.

To-day the face of the world is changing rapidly. The exploitation of minerals in Polar Regions, their development and importance for meteorology, their strategic and military significance as border regions between Great Powers; the airways which seek and find direct routes to their destinations, freeing themselves from the limitations of surface topography, and ironing out those geographic accidents which have hitherto shaped the course of world history and civilisation; these things have made the earth spherical. In peace, and especially in war, the world is for the *first* time shaping like a sphere, in which traditional routes, space relations and outlook no less than traditional time spans are giving way to new sets of factors, new orientations, links and fears, new combinations of peoples and commerce, new cross-roads in human history; in short, to new space relations. Accidents of surface topography no longer shape a people's destinies, for each nation now faces outward in all directions. The traditional Mercator map presented one universal view of the world, poised in happy balance and harmony east and west of the great centre of political stability and commercial leadership in Britain, a world map in which each country was expected to perform optical acrobatics to perceive its own true space relations. Too often they never made the effort needed and accepted the view of the world as seen through British spectacles. Now each country faces outwards in all directions, the earth is spherical, and time is shortened. So it must needs think of the world map with itself at the centre, the only valid and rational world map for any region, as the followers of the Prophet have always known.

The Interrupted Zenithal World Map therefore is not concerned to preserve equal area—for vegetation, or true shape—for navigation. It sets out to produce a world map which (1) can be easily constructed with its centre in any region, (2) preserves true direction from that place to the rest of the world, (3) preserves true distance to all other

parts of the earth's surface.[2] True orientation and true distance together spell true space relations, the most essential fact of geography. Such a quality is vital in a world map in the air age of the twentieth century.

Figure 1 shows a Zenithal Map of the World centred in the Balearic Islands of the Western Mediterranean. It extends without a break to the hemisphere, 90° from the centre, but is interrupted thereafter to preserve true direction, and approximate true shape and area in Australia and New Zealand. Antarctica is placed relative to New Zealand, from which it is most easily penetrated, and is of course arbitrarily separated from Australia, and from Patagonia. The position of the South Pole has been indicated, however, for a more central location for Antarctica. The map could easily have been constructed with centre at Madrid, Mecca, or Moscow, etc., but the Balearic centre gives the hemisphere which includes the greatest possible area of land compared to sea. Moreover, by including all the northern lands within the map hemisphere, it is easy to interrupt the Pacific region of the map to show the isolated southern lands in the lower portion of the map. Such a map serves very conveniently as a world map for Western Europe and the British Empire.

## Construction

The method of construction is mainly graphical and makes considerable use of transference. The projection is, to begin with, a Plane Zenithal Equidistant Interrupted. The plane is conceived as touching the spherical globe at the Balearics. All great circles intersecting in the Balearics will be straight lines intersecting at the centre of the projection, with true angles between them. For convenience they are drawn on the graticule at 30° interval. True scale is marked along these straight lines, corresponding with great circles or meridians on the globe, *i.e.* $2\pi R \times \frac{10}{360}$. This is marked off every 10° along one of the straight lines from the centre until 90° from the centre is reached. The graticule is completed by drawing circles, concentric to the centre of the projection, through these points marked on the selected straight line. So far all that has been done is to draw a Zenithal Equidistant as far as 90° from the centre. Suitable great circle lines are then selected and extended as straight lines for New Zealand, and for Australia. True scale is marked along these every 10° from the 90° circle. Concentric arcs are drawn through these points and then scale is marked off along these arcs by transference from the corresponding circle within the hemisphere. That is, the scale along arc at 10° beyond the hemisphere is made equal to that along the 80° circle from the centre ; at 20° beyond the hemisphere it is equal to that along 70° from the centre, etc., as required. By joining up these points marked on the arcs, with straight lines, the interrupted sectors of the graticule are completed.

A geometric network of intersecting spokes and concentric circles or arcs has now been constructed, but these lines and circles are not

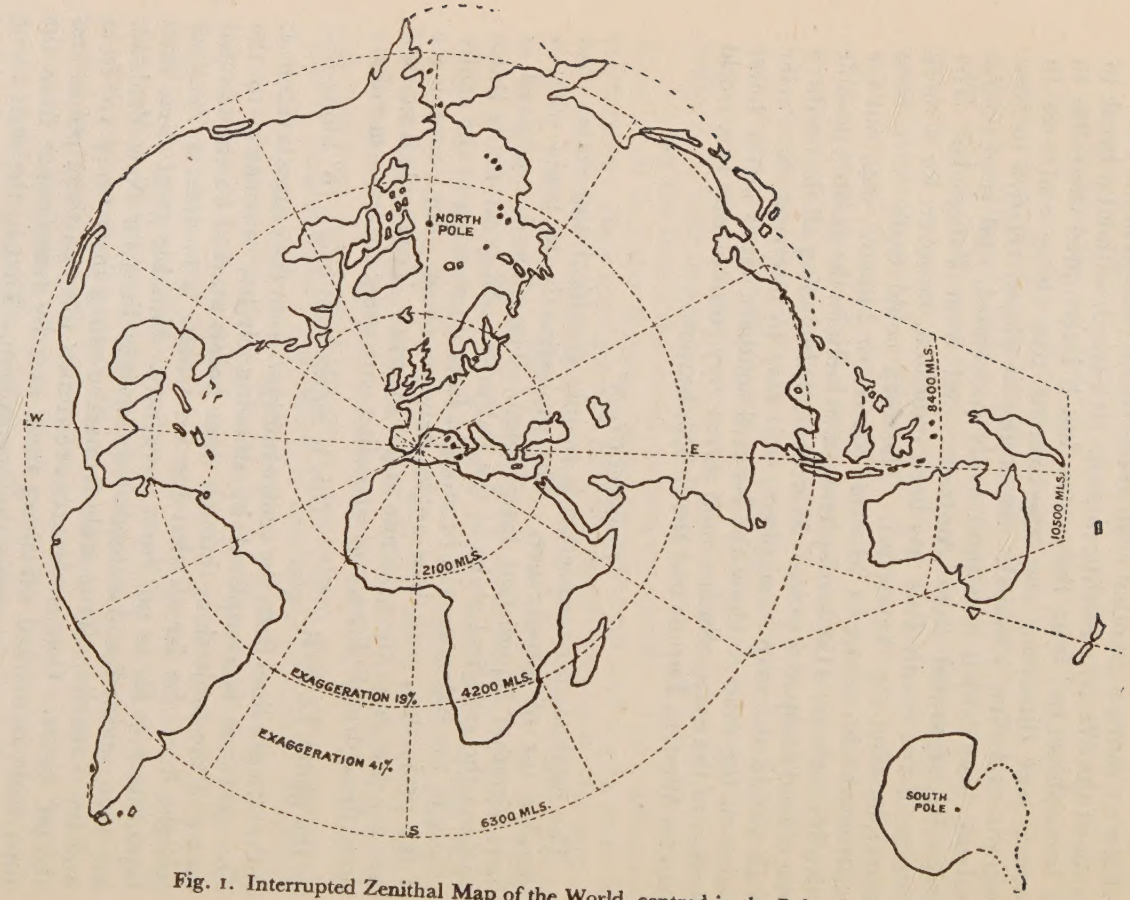


Fig. 1. Interrupted Zenithal Map of the World, centred in the Balearic Islands.

the meridians and parallels of the globe, nor do they even intersect at the same points. It is therefore necessary to use a slate globe which has the outline of the continents on it, and to draw a similar graticule on the spherical surface of the globe. Great circles intersecting in the Balearics at 30° interval are drawn on the globe, and true scale is marked along *each of them* every 10°. By joining up these points the concentric circles are obtained on the globe. By extending the great circles which pass through New Zealand on the one hand, and Australia on the other, the interrupted sectors are drawn on the globe as was done in the plane graticule. There are now two graticules, one on the globe and one on paper, similar in pattern but by no means identical. The outlines of the continents as they intersect the graticule drawn on the globe are transferred by eye to the paper, and the map is complete. Some of the constructed circles should be erased for clarity. Scale along a straight line can be marked, and variable scales along each of the concentric circles can be added. The process of drawing the graticule on the globe obviates the difficulties of computing positions in terms of latitude and longitude measured from Greenwich, a very complicated procedure. It is a process applicable to many constructions in mathematical projections.

The properties of the world map so drawn are :—

1. True direction from the centre to all parts of the earth's surface.

2. True distance from the centre to all parts of the earth's surface, which can be read off by eye.

3. No marked distortion of shape, scale or area save within 20° of the Pacific girdle periphery,[3] which is remote from the central regions. Be it noted that Antarctica, Australia and New Zealand are not in this zone of exaggeration, which makes this arrangement quite suitable for a map of the British Empire.

4. Within the central regions of the map the graticule is nearly perfect, with true distance, direction and true space relations to all the lands and regions around. It is particularly suited to map air routes through the central region.

Figure 1 could be modified so as to interrupt the graticule before the 90° circle is reached in Central America, and in the Arctic Ocean. In this way exaggeration of area and distortion of shape in the Pacific regions of Asia and the Americas could be greatly reduced. Nevertheless the introduction of such an exaggerated gap between North and South America in the one case, and between Canada and the U.S.S.R. in the other, would distort the political and strategic geography of the world, which profoundly concerns every part of it. Such forms of interruption should be used with care only for special purposes, *e.g.* economic geography. They should never be used for a general map of the world, nor for world maps in political geography, geology, physical geography, meteorology and climatology.

REFERENCES

[1] TAYLOR, E. G. R. *Geography in an Air Age.* London : Royal Institute of International Affairs, 1945.

[2] The mathematician will instinctively suspect a fraud in this claim, for he believes that true distance can be shown only along meridians or parallels and never along both. This is true of a universal world map ; but by making an individual world map for each country all distances to other regions radiate from it in straight lines which are great circles ; along these, true scale can easily be preserved as well as true direction.

[3] The exaggeration of scale along the 80° circle from the centre is 41%. This is very small compared to Mercator or Gall at 80° parallel. At 60° from the centre of the map it is 19%, whereas Mercator exaggeration at 60° parallel is 100%.

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# THE HEAD-DYKE : A FUNDAMENTAL LINE IN SCOTTISH GEOGRAPHY

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By ISOBEL M. L. ROBERTSON

BOUNDARIES of natural regions are always difficult to define precisely. One of the chief reasons is that the limits of the distribution of the intrinsic characteristics of a region seldom coincide. A line which simultaneously separates several contrasted features is unusual. Such a line, however, is that traced by the head-dyke, a stone boundary wall, common throughout Scotland and marking the extent of improved land. The head-dyke is thus of inestimable value in Scottish geography since it gives a key to regional analysis, as well as indicating the extreme limit of land which can be worked agriculturally and which can support a rural population.

The head-dyke is a dry stone wall built across the head of every farm before the era of general enclosure, " to secure the effectual separation of hill pasture from the arable and meadow grounds." [1] Observation in certain districts shows that it is not always the natural boundary which Robertson [2] described in Perthshire but a man-made limit to land which could be conveniently worked and which could support crops and cattle sufficient for his livelihood. In many places the head-dyke does, of course, coincide with a natural boundary like that of sudden increase of slope with consequent increase in exposure, decrease in soil cover and difficulty in ploughing, or that of disappearance of effective drainage or of productive soils.

It is most conspicuous in winter, when it delineates the bluish-grey rocks, purplish-brown heath and crotal bracken of rough grazing and agriculturally derelict land from the green of agricultural land. Age has tended to emphasise the difference, especially in districts where the boundary is not natural, for the land inside the dyke has been more or less continuously cropped or grazed and has thus never recovered its natural vegetation cover.

The head-dyke is not often the present-day boundary of agriculturally exploited land, as the crops-and-grass land seldom now extends

as far. In the Highlands, especially, the head-dyke may present a tumble-down, overgrown appearance and serve only as shelter for cattle from rain and storms. But the value of the dyke to the geographer remains constant and high.

By one line, the head-dyke marks the limit of both physical and human phenomena. It distinguishes contrasted relief, soils, vegetation, land use and settlements by a ubiquitous, non-fluctuating line, recognisable alike in the field and on the map, and sanctioned by tradition. It encloses land of relatively uniform value agriculturally. Further, as Stevens [3] shows, it marks the extreme limit to the area available for utilisation and habitation by rural population.

In addition, the head-dyke indicates the position at which a balance has been struck between fundamental elements of geography, rural man and his physical environment. Man's energies vary along the head-dyke. They are influenced by tradition, technical efficiency, standard of living and economic situation. The forces of nature also vary and to a much greater extent. They are primarily important in affecting the position of the dyke.

Other writers [4, 5] have attached considerable significance to the moorland edge. But the head-dyke is far superior to and should supersede the moorland edge, which, unlike the dyke, is an ill-defined line, varying in position from year to year in relation to changes in agricultural economy. The moorland edge is difficult to recognise on the ground and impossible to trace with any accuracy on a map. It marks a limit of only temporary equilibrium and has no historical foundation.

The head-dyke has superficial affinities with the "moor wall" described [6] in Craven (Central Pennines) as separating the better rough grazing on limestone from the poorer type on millstone grit and shale, and as differentiating land tenures and utilisation. The "moor wall," however, does not appear to be the upper limit of improved land, for there is no indication that the rough grazing below the wall has reverted from former improved pasture.

## Mapping and Measurement

The methods adopted for the study of the head-dyke have been mapping of the feature followed by a regional description and interpretation, and measurement of areas enclosed by the dyke followed by a comparison with statistics published by the Department of Agriculture.[7]

The head-dyke is shown on the one-inch Ordnance Survey maps of Scotland, most clearly on the Third Edition Black, and has been reduced by pantograph from these sheets—copper-plate when available, because of greater clarity and accuracy—on to a base map of scale 1:625,000. Occasionally, especially in wooded valleys like Deeside, the course is broken and can be only approximately followed by the contour most closely approaching the average height of the dyke in that area. The patchy, discontinuous nature of the dyke on the west coast and Outer Isles made desirable there mapping on a larger

scale, 1:316,800. Other areas of particular interest were mapped on this scale too.

To illustrate the considerable variation in altitude (100-1200 ft.) of the head-dyke, the contour corresponding to the average position of the dyke for a distance of not less than ten miles was mapped. The contour is valuable, too, in that it indicates a maximum limit to expansion of cultivation where a wide margin exists between the areas enclosed by the head-dyke and contour. The base map has not been included in this paper, as it would appear on too small a scale to show other than the broadest of features. In addition, dyke and contour would coincide over large areas. Figures 1-7 taken from the base map give some indication of the main features of the dyke.

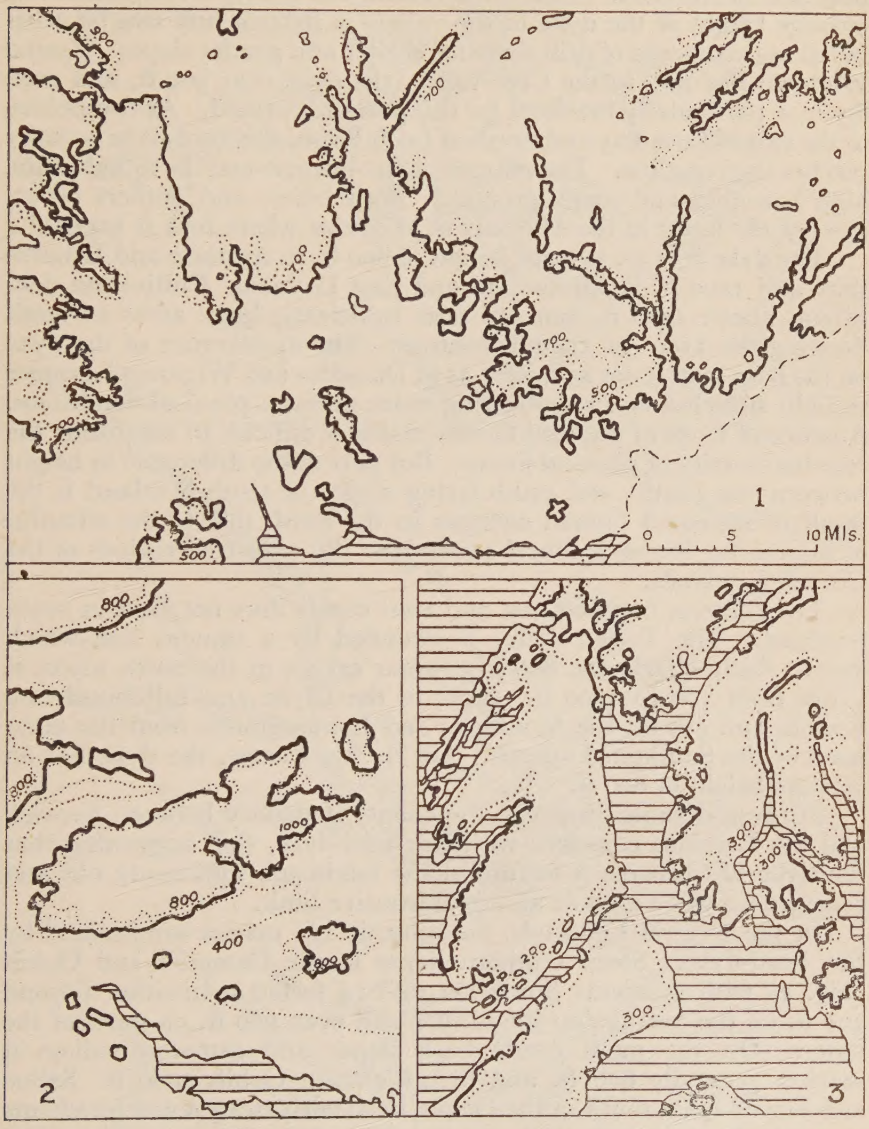
Measurement was made with a Coradi planimeter of the area enclosed by the head-dyke in each of the 33 counties, in 100 agricultural districts—used by the Department of Agriculture—and in some parishes, on the scale of 1 : 316,800 when available, of 1 : 63,360 for parishes and parts of the west coast and outer islands, otherwise of 1 : 625,000. Towns, except Glasgow and Edinburgh, small woodlands and the smaller water surfaces were not rigorously excluded, except where possible on the one-inch maps. The area under the contour was measured in counties and in certain agricultural districts.

## Regional Study

A general survey of the base map confirms that the most obvious feature shown in the mapping of the dyke is the apparent influence of altitude. This is to be expected in Scotland where altitude gives rise to many unfavourable physical factors. Uplands and Highlands stand out clearly. Through valleys are conspicuous. But it is rarely altitude itself which affects the position of the dyke, but rather the attendant features such as high rainfall, low temperature, lack of alluvial or fluvo-glacial deposits and generally steeper slopes. Attempts were made to find a method of mapping some of the physical factors, viz. slopes impracticable for cultivation, efficiency of drainage, etc., but had to be given up partly because of lack of information and partly because of difficulty in mapping relative and intangible factors.

Altitude is naturally not constant. Variation in elevation is most strongly marked between the east and west coasts, from the latitude of Kintyre northwards. The height of the head-dyke is only 100-200 ft. on the west coast, while on the east coast directly opposite it is 700-800 ft. except in east Sutherland and Caithness, where it is approximately 400 ft. The respective average heights on the north and south coasts are 250 ft. and 500 ft. Maximum height of 1200 ft. occurs in restricted areas in Aberdeenshire, Ayrshire and the Lothians, while minimum height of 100 ft. is widespread in the Outer Hebrides, Orkney and Zetland. The elevation of 200 ft. has the greatest areal extent, but the actual length of the dyke at this height is probably smaller than at 700 or 800 ft. because of the discontinuity of the feature at 200 ft. The contrast between east and west coasts north of Kintyre is also marked in the course of the head-dyke. On the rugged west coast, it

is interrupted for long stretches by the coastline, while on the lower, gently rolling eastern coastlands it is far inland and continuous though tortuous. Throughout Scotland, indeed, with the exception of the indented west coast, the course of the head-dyke presents a more or




The head-dyke. Fig. 1. Dumfriesshire. Fig. 2. Ochil Hills. Fig. 3. South Argyll and Bute. Based upon the Ordnance Survey Map with the sanction of H.M. Stationery Office.

less continuous line, varying in sinuosity and having small inliers of cultivated land and outliers of moorland, respectively above and below the general level of the dyke.

In south Scotland, the head-dyke tends to be lower in the south

than in the north. In Dumfries (Fig. 1), the head-dyke presents a frayed outline at 500 ft. at the English border-line, increasing to 700 ft. in Eskdale and continuing at that height round the Annan valley and into Nithsdale, where it merges with the 900-ft. level of that part of Ayrshire. The delineation of the valleys and often above-average height of the dyke in the valleys is striking and can be attributed to occurrence of drift deposits, shelter and gentler slopes. Round Wigtown Bay and in the Cree valley, the dyke is at 300 ft. and even lower, a particularly low level for this part of Scotland. At two points, in the east of Luce Bay and north of Loch Ryan, the head-dyke actually reaches the coastline. The reason for the lowness may be found in the high humidity and soggy ground.[8] Both inliers and outliers occur, most of the latter in the Machars of Wigtown where rock is exposed.

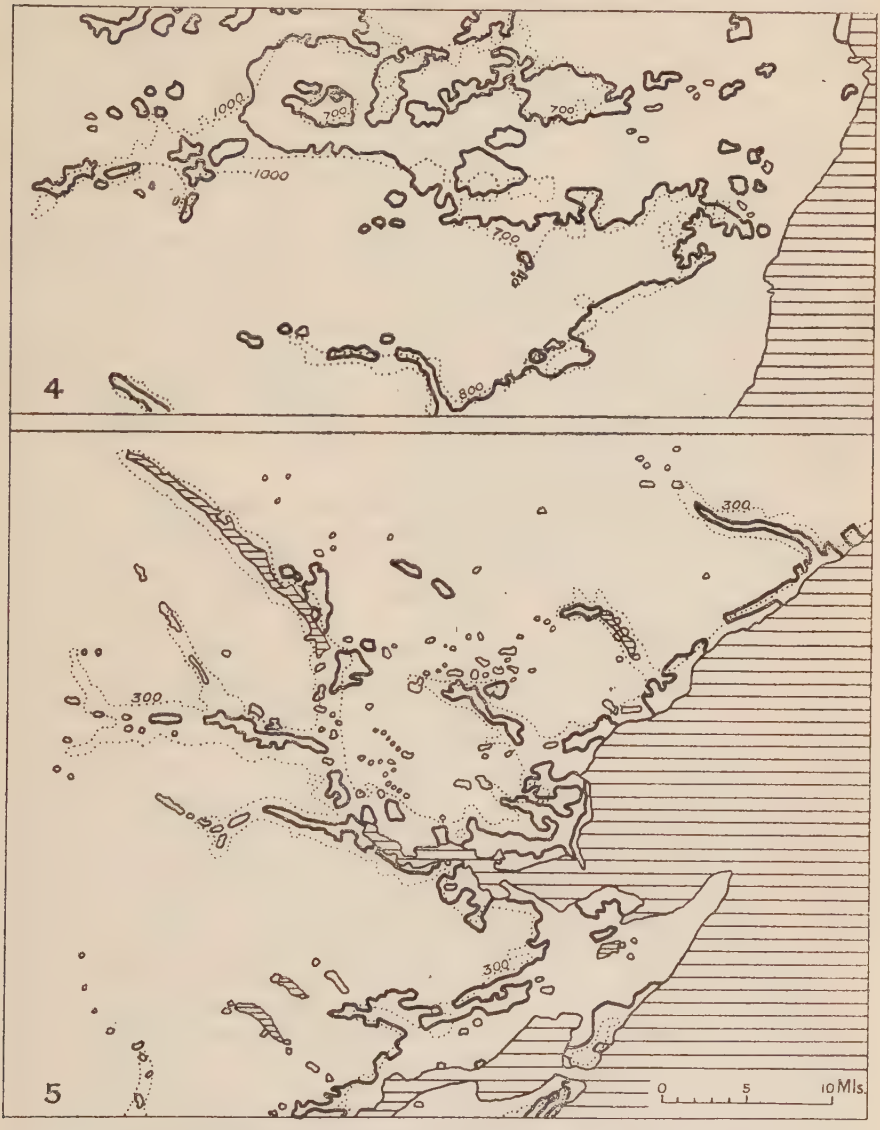
The dyke is at an average height of 800 ft. in Ayrshire and Lanarkshire and 1000 ft. in Midlothian and East Lothian. Cultivation does extend above 1000 ft., but not over sufficiently large areas to merit drawing the 1100- or 1200-ft. contour. The appearance of the dyke on the base map is not as ragged as in Dumfries and Wigtown. Longer straight stretches occur, indicating more uniform physical conditions. Absence of maps of physical factors makes it difficult to determine the relative severity of physical forces. But part of the difference in height between the north- and south-facing slopes of south Scotland is the result of increased human energies in the north due to the stimulus of the market for agricultural produce in the industrial regions of the Central Lowlands.

The contrast between east and west coasts does not exist in south Scotland. The Tweed valley is bounded by a sinuous line which follows fairly closely the 800-ft. contour except in the north where it varies from 700 to 1000 ft. Exits to the Clyde and Edinburgh are obvious and cut off the Moorfoots and Lammermuirs from the main mass of the Southern Uplands. On the west coast, the dyke has an average height of 800 ft.

For considerable distances, the county boundary between Berwick and the Lothians coincides with the head-dyke, thus suggesting that the dyke has become a feature of the landscape sufficiently old and conspicuous to be used as an administrative limit.

In the Central Lowlands, the volcanic hill masses are isolated by the head-dyke. Steep southern slopes in the Campsies and Ochils (Fig. 2) with gradients from 1 : 2 to 1 : 4 forbid cultivation beyond 400 ft. on the average on the former and even 200 ft. on parts of the latter. On the more gentle back slopes and east-west valleys it reaches generally 800 ft. and in the eastern Ochils 1000 ft. Saline and Knock Hills, south of the Ochils, have fairly steep slopes (gradients 1 : 2·5 to 1 : 5) and reach over 1100 ft. and yet have no sign of the head-dyke. This is an indication of intensive agricultural energy. 700 ft. is the general level of the dyke in the Renfrewshire Hills and Sidlaws. Flanders Moss, an area of peaty, undrained moorland between 50 and 100 ft. in the upper Forth, precludes exploitation by rural man. Poor drainage also accounts for low moorland in Lanarkshire and east Dunbartonshire.

Long trench-like valleys, farmed to 800 ft. and over, penetrate the almost straight northern edge of Strathmore. Outliers of low moorland 400-700 ft. occur along most of its length except between Comrie and Dunkeld. The largest valleys are those of the Earn and Tay systems




The head-dyke. Fig. 4. Aberdeenshire. Fig. 5. East Sutherland.
Based upon the Ordnance Survey Map with the sanction of H.M. Stationery Office.

which are often loch-filled in the upper stretches and mostly permit cultivation only where rivers build small fans at their junction with the lochs. It is noticeable that the long arable stretch on the north, i.e. south-facing side, of Loch Tay has a higher upper limit at the south-west end than on the south side. This reflects the advantage

of southern aspect. Most of the valleys are prolonged in detached fields on patches of finer alluvial soils. Larger areas of cultivation are found above the 800-ft. level where broader stretches of alluvium are available, as in Glens Fruin, Shee, and Isla.

As the head-dyke turns west, north of Stonehaven, it assumes a different appearance (Fig. 4). It becomes more indented, as in Kirkcudbrightshire, and reaches 1000 ft. and over in upper Dee and Don. This high level can be attributed to tradition and historical influences.[9] The advantage of south-facing slopes is more marked here than in Loch Tay. For a considerable distance, the elevation of the dyke is 300 ft. greater on the north side of the Dee than on the south.

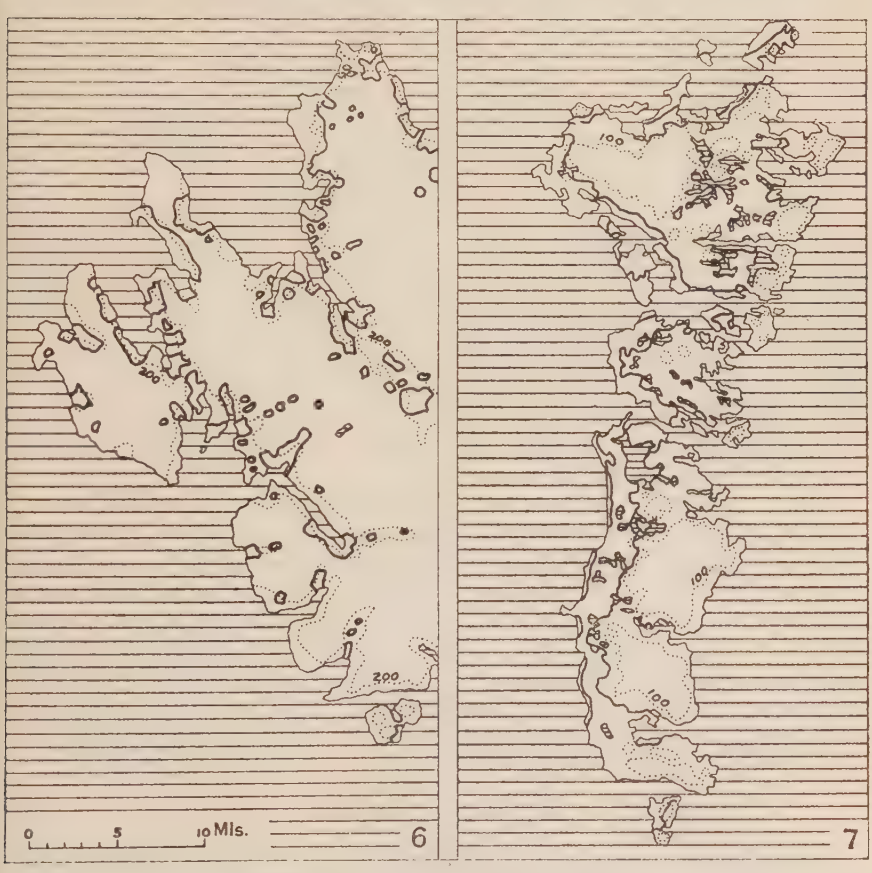
Westwards towards the Spey the level of 1000 ft. is preserved, with the exception of Ben Rinnes and the Hills of Cromdale, where it is 800 ft. The average height in Speyside is 800 ft., but upstream of Kingussie and in tributary valleys 1200 ft. is reached. Indeed, patches of cultivation occur all along the through valley of the upper Spey, Loch Laggan, and Glen Spean. On the coast, almost continuous between Nairn and Buckie, are strips of windblown sand incapable of supporting crops. Other such strips exist north of Montrose, of Aberdeen, and of Peterhead.

Towards Inverness the head-dyke elevation decreases to 500 ft., largely because of shortening of the growing season, and merges with the 300-ft. level of Glen More. In the Glen itself, cultivation is restricted to narrow stretches bordering the lochs and to the northern tributary valleys.

Round the Moray Firth coastlands, the head-dyke follows the 500-ft. contour except in the straths, where it is discontinuous, and in the Black Isle, where the average height is 400 ft. In the Dingwall neighbourhood, the dyke descends to 300 ft. (Fig. 5) and continues thus with few breaks, and with prolongations up the major straths, to the Caithness lowland. In east Sutherland and Caithness, the dyke is nearer the coast—and, in fact, meets the coast—than at any other part of the east coast. It is noticeable in the Oykell system that it is higher on the north side, pointing again to the advantage of the sunny aspect. Another feature in this area is the number of small scattered fields, the presence of which may indicate scarcity of suitable ground for agricultural purposes and possible keenness of population to make the best use of available land. A triangle of low moorland with its vertices at Dunnet Bay, Duncansby Head, and north of Sinclair's Bay occupies a large percentage of the area of Caithness lowlands below the general 250-ft. height of the dyke.

The Highlands and Islands (Figs. 3, 6 and 7) differ markedly from the rest of the country. Improved land is restricted to patches along the coast, on the raised beaches, isthmuses and fiord heads, on loch sides, especially where rivers have built alluvial fans, at mouths of small streams and in coves and inlets. On the mainland and inner Hebrides, the head-dyke is at 200 ft. On the outer Hebrides, it is at 100 ft. This lowness of the limit of cultivation on the west coast is partly attributable to the much heavier rainfall.

Slopes are great and rainfall high on Lochs Long, Fyne, Awe and Leven (Fig. 3), and prevent anything other than the typical Highland discontinuous head-dyke. Lack of communications and isolation probably account for long stretches of coastline in southern Mull and on the northern shores of Loch Linnhe without any trace of the dyke. Poor drainage, demonstrated by the number of lochs in Inverness, Ross and Sutherland, and the high rainfall conspire to reduce the amount of cultivated land right up the west coast, especially north




The head-dyke. Fig. 6. Western Skye. Fig. 7. Uist.
Based upon the Ordnance Survey Map with the sanction of H.M. Stationery Office.

of the Firth of Lorne. In Sutherland, the number of fields worked is, roughly, inversely proportional to the number of lochs. The 200-ft. contour running out to sea shows the cliff-like nature of the coast in Skye and north-west Sutherland. In Skye (Fig. 6), it is noticeable that where the 200-ft. contour appears on the coastline marking a cove, there is generally a patch of cultivation.

On the north coast of Scotland, cultivation is dispersed along the coast and in the major valleys when not loch-filled, since they provide shelter and drift materials suitable for soil development. There is no

cultivation in the Strathy valley although a considerable part is under 300 ft. and it is not water-filled. The same feature is evident in north Lewis in a valley facing north. Relatively sunless aspect is a possible explanation.

Lewis and Harris are comparable with the inner Hebrides in having a peripheral distribution of farmed land. The largest areas of cultivation are in the Stornoway district and north-west coast. In Harris, a strip of cultivation avoiding the actual coast points to its sandy, marshy nature. Uist (Fig. 7) differs greatly from Lewis. The head-dyke is fairly persistent and is almost entirely limited to the west coast. It bounds relatively large areas of machair, sandy lowland composed of silted lochs and lagoons. As in Sutherland, it is almost completely absent in the extensive areas of irregularly shaped lochs. This unfavourable effect of poor drainage is a particularly obvious feature in Benbecula (Fig. 7).

Orkney and Zetland bear a striking resemblance to Uist and Lewis respectively. The Orkneys, though a structural continuation of the Caithness lowland, have a lower head-dyke—100 ft. Little relationship exists between the dyke and contour as in parts of Uist. The lowness of the limit of land improvement may be due partly to isolation, but more probably to northerly position causing a shorter growing season and cooler summers. Only half of the area of Zetland under the significant contour (100 ft.) is cultivated, while in Orkney it is something like 3 per cent. extra. Zetland suffers from the presence of peat and acid soils.

Islay, Kintyre, Arran and Bute (Fig. 3), although popularly classed as Highland, are different in certain aspects. Excepting Islay, the dyke is at 300 ft. Larger and more continuous stretches of farmed land are found, as on the alluvial deposits and raised beaches of Laggan and the west coast of Kintyre, on the raised beaches round Bowmore and Gruinard Bays in Islay, and on the sandstone and raised beaches of south and central Bute. It is evident that, despite its exposure, western Kintyre is more favourable to cultivation than eastern. This is largely due to better soils and more gentle slopes.

## Statistical Study

Only 34 per cent. of Scotland is enclosed by the dyke. Percentages vary widely among the districts. St. Cyrus (Kincardine) has 100 per cent. of its area available for cultivation, while Lochaber (Inverness-shire) has only 2·6 per cent. Most Highland districts occur under the 20 per cent. level—Lewis 7, south-west Ross 4, Mull 16 per cent., etc. Districts, largely lowland, are above 90 per cent.—Carnoustie 99·5, St. Andrews 99, Bathgate 98, Lanark 97, Aberdeen 96. Figure 8, constructed by drawing squares for each county, proportional to the area of the county, and placing them together in their relative geographical position, shows the county percentages. This diagrammatic representation of Scotland has the advantages of exposing at once relationships with geographical situation, of showing the percentages related to the varying size of the counties, and of facilitating study of

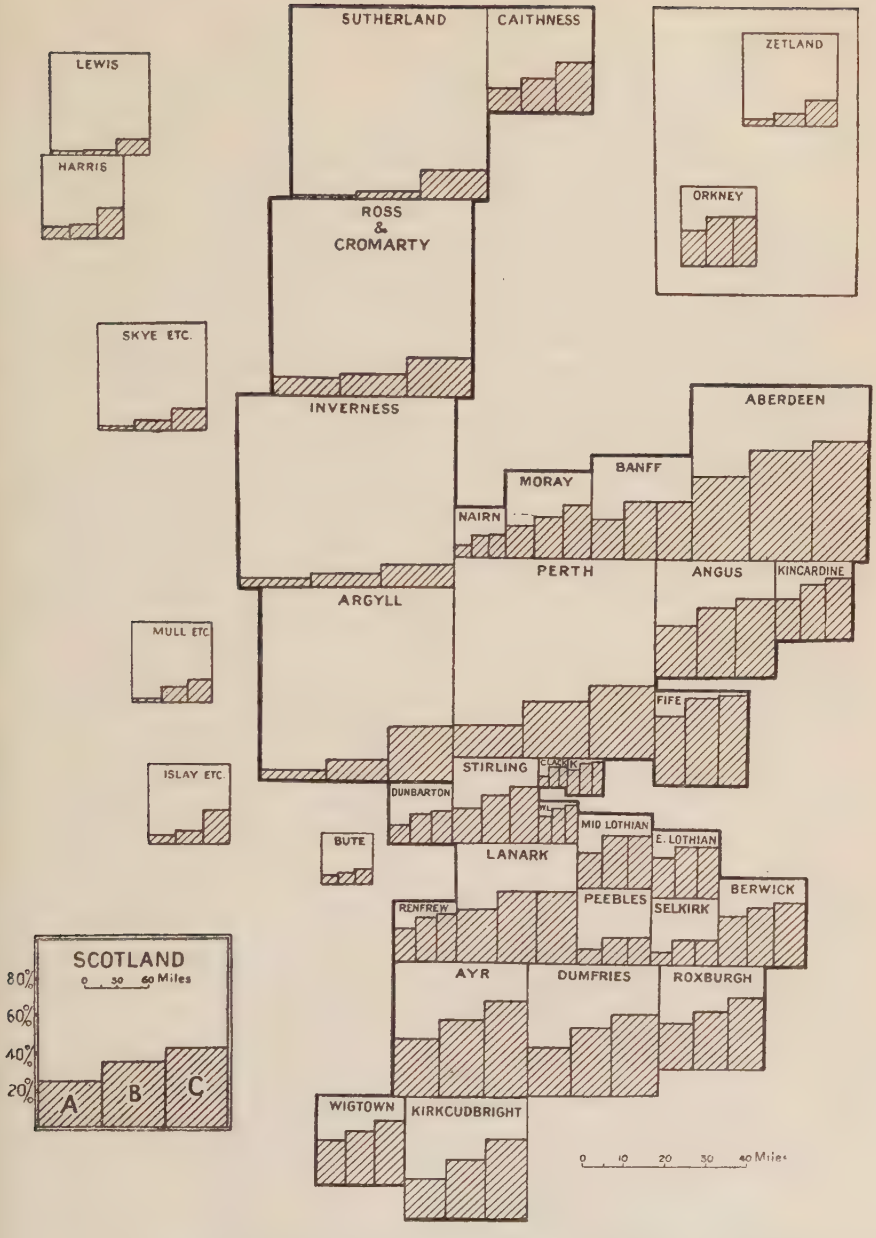



Fig. 8. Scotland. The squares are proportional to the areas of the counties and placed in their relative geographical position. The columns within each square represent: A. Area under crops and grass. B. Area below head-dyke. C. Area below contour. Columns A, B, and C are each equal to one-third of the area of each feature.

the country as a unit. It was unfortunately impossible to fit in the 100 agricultural districts to such a plan. The ' map,' however, serves as a convenient method of summarising general features. The greater acreage of the Highland counties and islands—Perthshire, Argyll, Inverness-shire, Ross, Sutherland—and the much smaller proportion of improved land are striking and emphasise their cleavage from the Lowlands. Orkney and Caithness cannot be regarded as Highland.

The other columns plotted on the map show area at present cultivated, i.e. under crops and grass, and extreme area of future cultivation, i.e. below the contour. In every county, and district, the area at present worked is smaller than that formerly. The difference is made up of agriculturally derelict land, rough grazing, low woodland, buildings and roads. It is not possible to estimate the different proportions of the components of the difference, but it can be assumed that agriculturally derelict land has its highest proportion in the Highlands, and buildings in the Lowlands. District percentages show that Highland districts have generally under 50 per cent. of their area colonised by rural man now farmed: Mull 25, Ardnamurchan 34, Skye 36, Lochaber 40 per cent. This 50 per cent. corresponds, of course, to about 10 per cent. of the total area of the county or district. Decreased dependence on the land, associated with improved standard of living, is responsible for the reduction of the land under cultivation in an area where such land was scarce and often unremunerative under former ways of working. Good farming lands are worked almost to the head-dyke : Linlithgow 86, Ellon and Turriff 86, Kilmarnock 83, Machars 86 per cent. Scotland, as a unit, farms 72 per cent. of the improved land, approximately 24 per cent. of its total area.

In most counties, the area enclosed by the dyke is smaller than that enclosed by the corresponding contour. In Scotland generally, it is 80 per cent., but in Argyll, Sutherland and Zetland it is as small as 45 per cent. The explanation is, simply, that in those typically Highland counties the area enclosed by the head-dyke is patchy, while that enclosed by the contour is more or less continuous. In Lanark, Midlothian, East Lothian, and certain other counties the area below the dyke is greater by a small margin than that below the contour but has been shown equal in Figure 8, as the difference is largely due to choice of contour since it was desirable to preserve a contour height through geographical entities rather than administrative divisions. With the exception of Orkney, these counties are adjacent and the contour involved is that marking the northern limit of the Southern Uplands. In Lanark and Midlothian, the difference can be attributed also to the fillip given to agricultural activity by the high degree of urbanisation.

That the greater part of the difference between land formerly and at present worked is made up of rough grazing is shown clearly by Fig. 9, a scatter diagram, in which the area below the head-dyke is plotted against the area under crops and grass (land at present worked) and rough grazing. Over 60 per cent. of the values obviously fall about the line $x=y$. The other 40 per cent., which are almost exclusively Highland districts, are distinct and have an extent of crops, grass

HEAD-DYKE AT BROUGH DARG, GLEN SHEE

HEAD-DYKE AT SILVERBURN, PENTLAND HILLS

and rough grazing exceeding that of improved land by as much as 18-fold in Lochaber and Ardnamurchan, 16-fold in Sutherland, and 15-fold in Lorn. In these districts generally over 50 per cent. of the improved land is now designated rough grazing. It is, no doubt, of better value than that outwith the dyke, for it has been limed or fertilised at some time. This extensive utilisation of moorland for sheep and cattle grazing is necessary in the Highlands where agricultural land is scarce, and since, as Stevens shows,[10] the value of rough grazing is only 3 per cent. that of permanent grass. In the Lowlands, however, most of the rough grazing is on reverted improved

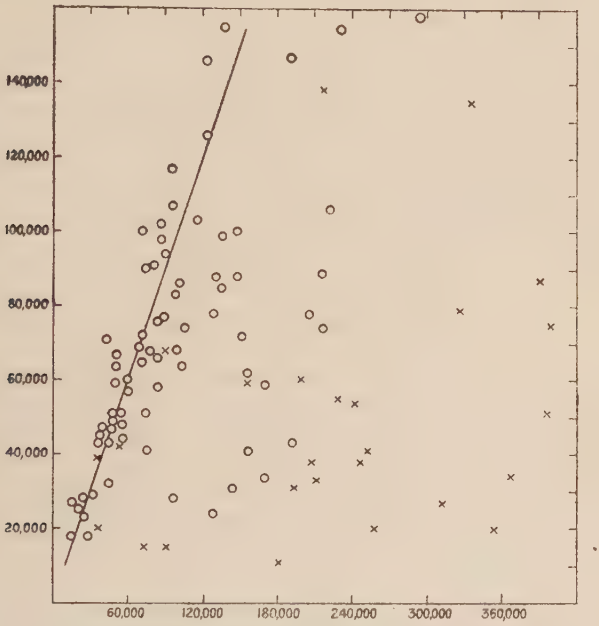



Fig. 9. Agricultural districts of Scotland. Scatter diagram of acreage under crops, grass, and rough grazing (abscissae), and acreage below the head-dyke (ordinates). The line ($x=y$) is not a computed regression line. Sutherland is not shown, as it does not correspond in size to the other districts (abscissa 1,008,000; ordinate 63,000). × indicates Highland districts.

land. The Orkney districts and Avoch (Ross-shire) are the four, indicated as Highland on the scatter diagram, which appear among those districts related to the line $x=y$. Orkney, as previously, could be excluded from Highland classification. Caithness, however, in this figure, is markedly Highland.

In three counties, Fife, Kinross and West Lothian, crops, grass, and rough grazing unitedly make up only 83, 96, and 84 per cent. respectively of the land below the head-dyke. The residue is built-up area, woodland, rock, and heath common to all areas. The discrepancy, however, is an indication that the dyke has been extended to a maximum position in these counties, an interpretation strengthened

by the fact that contour and head-dyke are almost coincident there.

That the land below the head-dyke has uniformity in agricultural value is confirmed by the fact that it supported a rural population with methods of cultivation, standard of living and density on improved land relatively constant throughout the country. The swing from a purely rural to a largely industrial economy caused variations in standard of living, but the head-dyke was built when the majority of the population was directly dependent upon the land. Again, variations in density of rural population on improved land are probably a comparatively recent occurrence. Present-day high densities are associated with the Highlands and with industrial areas of high concentration of urban population (see Appendix). In the Highlands growth of population was continuously suppressed until after 1745 when clan warfare ceased.[11] It is impossible to determine the degree of uniformity. Estimates have been made [12] of the capacity of different types of land to support population, but it is doubtful if the mutual dependence of arable and pastoral ground and the combined action of factors like cost of labour (both human and mechanised), cost of fertilisers, ease of marketing, etc., can be assessed statistically.

## Summary and Conclusions

The head-dyke in its continuous course from Rhu to Thurso distinguishes clearly to the north and west an area which possesses many inherent features and which may be termed Highland. This area is at once different in altitude, degree of slope, nature and depth of soils, drainage, natural and cultivated vegetation, agricultural economy, density and distribution of settlements, since the head-dyke marks a natural division of each of these features. Some of its specific characteristics are the patchy nature and small percentage of improved land, lowness (100-200 ft.) of the head-dyke, large percentage of agriculturally derelict land and of rough grazing, and high density of rural population on improved land. Other characteristics of relief and settlement distribution have been illustrated by Huggins,[4] who seeks a limit to the Highlands by plotting the boundaries of various relevant phenomena. A composite limit derived from his work is in general accord with the above-mentioned course of the head-dyke.

The remainder of Scotland may be termed, in contrast, Lowland. It includes several fairly extensive outliers of the Highlands—in the central volcanic hills and in the Southern Uplands. Those few outliers are individually greater in acreage than any of the numerous inliers of the Lowlands in the Highlands. This basic two-fold division of Scotland should be a fundamental geographical concept. It is borne out by the study of the head-dyke and has been apparent to the writer in every aspect of the subject studied.

The head-dyke is then a unique, constant and ubiquitous limit of considerable academic significance and of practical value. As well as serving as an instrument for study of Scottish regional geography, it indicates the position at which equilibrium has been reached between

the energies of rural man and adverse physical forces. Although sometimes in ruins and rarely the present-day boundary of crops and grass, the dyke is valuable for the shelter it affords to cattle and sheep. It has practical value too, in this era of town and country planning, in that, as Stevens has shown,[3] it marks a limit to the area available for settlement by rural population.

The author is indebted to Professor Stevens of the University of Glasgow for facilities in his Department, and to him and members of his staff for guidance and criticism.

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## APPENDIX

Density of total rural population is approximately twice that of basic rural population—agriculturalists and miners. Density of agricultural population on the area below the head-dyke in each of the agricultural districts of Scotland has been calculated. Some consideration has been taken of the mining element in the districts affected. The mean density of basic rural population in Scotland is approximately 45 to the square mile of improved land. Highest densities occur in the Highlands (Lewis 129, SW Ross 103, Lochaber 76) and in the highly industrialised and urbanised areas (Lanark 220, Dunbarton E. 110, Lasswade 94).

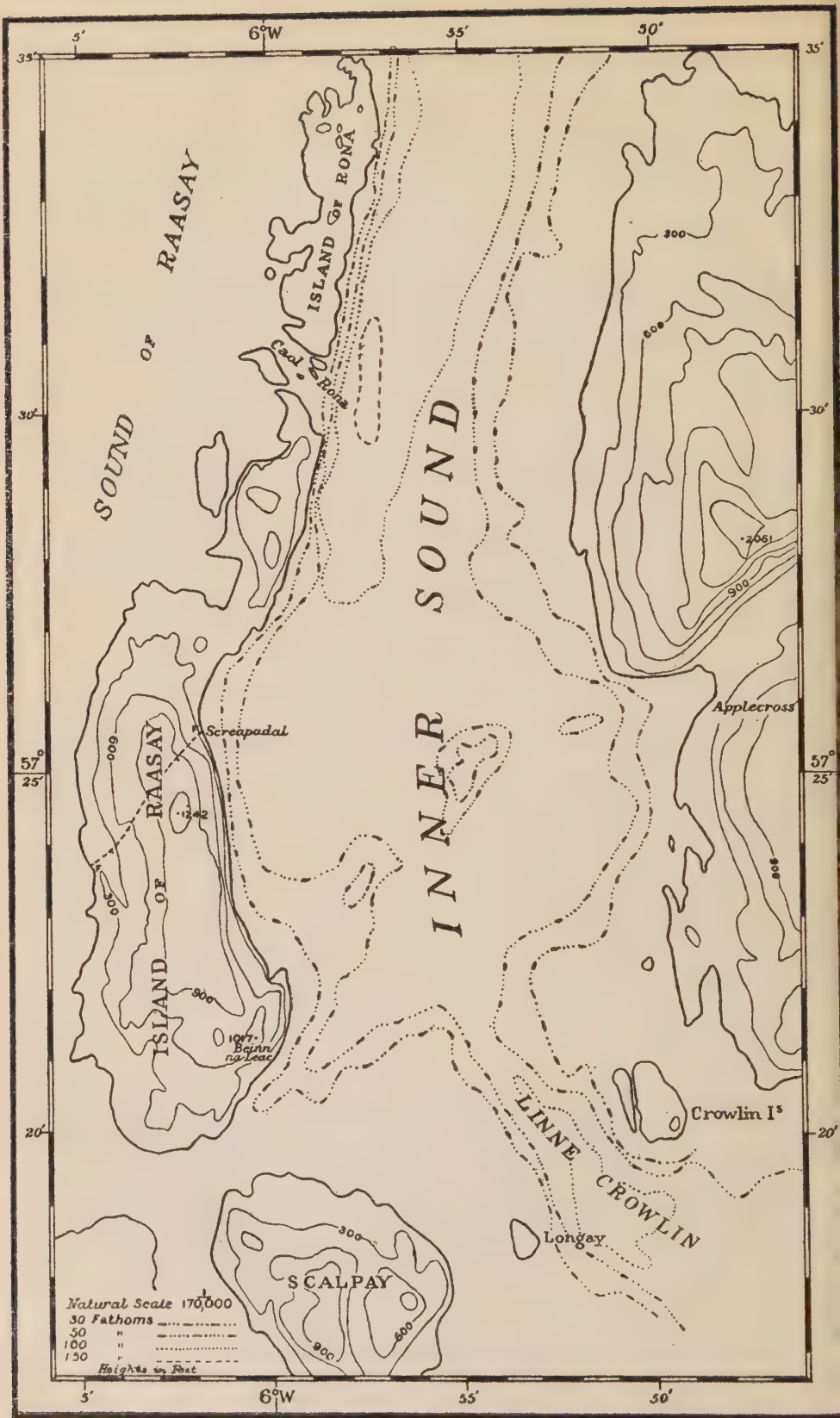


FIG. I. THE SUBMARINE MORPHOLOGY OF THE INNER SOUND.

# DEEP CLEFTS IN THE INNER SOUND OF RAASAY

By A. H. W. Robinson

Within the last six years, hydrographic surveys with modern echo-sounding equipment have been made over a limited area in the Inner Sound between the islands of Rona, Raasay, and Scalpay and the adjacent western coast of Scotland. In 1943 one of H.M. Surveying Ships examined the sea bottom off southern Rona, and in 1948 another survey was made of Linne Crowlin, which lies between Scalpay and the Crowlin Islands. Apart from occasional examinations of shoal patches, this area had not been surveyed for nearly a century. The new results reveal submarine features which it is thought may be of interest to geologists and physical geographers.

During the earlier survey carried out by Captain Otter in 1851, depths were obtained by hand lead every half mile along parallel lines some 2000 feet apart. No really detailed picture of the morphology of the sound therefore emerged, and it has been possible for later workers to conclude that the floors of the sea lochs are usually flat and featureless. The survey did show, however, that the axis of deep water ran quite close to the islands of Raasay and Rona (Fig. 1).

The most striking feature disclosed by the new survey is the elongated basin-like deep off Caol Rona. In Fig. 2, where bathymetric lines are drawn for every 10 fathoms and land contours for the same interval, it will be seen that this is enclosed by the 140-fathom line. The greatest depth observed was 177 fathoms (1062 feet), the deepest sounding so far recorded within the limits of the continental shelf round the British Isles. It exceeds by 75 feet the depth of 987 feet below sea level recorded in freshwater Loch Morar by Murray and Pullar in June 1902 which has hitherto been regarded as quite exceptional. The newly discovered feature, to which the name of "cleft" seems most appropriate, is also much greater in area than its counterpart in Loch Morar, since below the 160-fathom line (960 feet) it is over $1\frac{1}{2}$ miles long and up to a $\frac{1}{4}$ mile wide, whilst Loch Morar has only about 4 acres below this depth.

The cleft is not symmetrical about the axis of deeper water. A section drawn across from east to west shows that the western slope is much steeper than its eastern counterpart (Fig. 3). In some parts the western slope attains an average gradient of 1 : 3, whereas the eastern slope is seldom steeper than 1 : 7. The bottom of the cleft is apparently flat, an area of more than $\frac{1}{4}$ mile in length varying less than 7 fathoms.

Although the depths in Linne Crowlin are not as great as those recorded off Caol Rona, the 1948 survey revealed another cleft which is narrow in the north but widens southwards into a deep, almost circular, hole. It was in this part that a depth of 138 fathoms (828 feet) was found (Fig. 4). Between the two clefts the floor of the Sound is apparently much shallower, particularly in two patches which probably represent the submarine continuation of the Inferior Oolite sandstone so prominent in Beinn na' Leac in southern Raasay (Fig. 1).

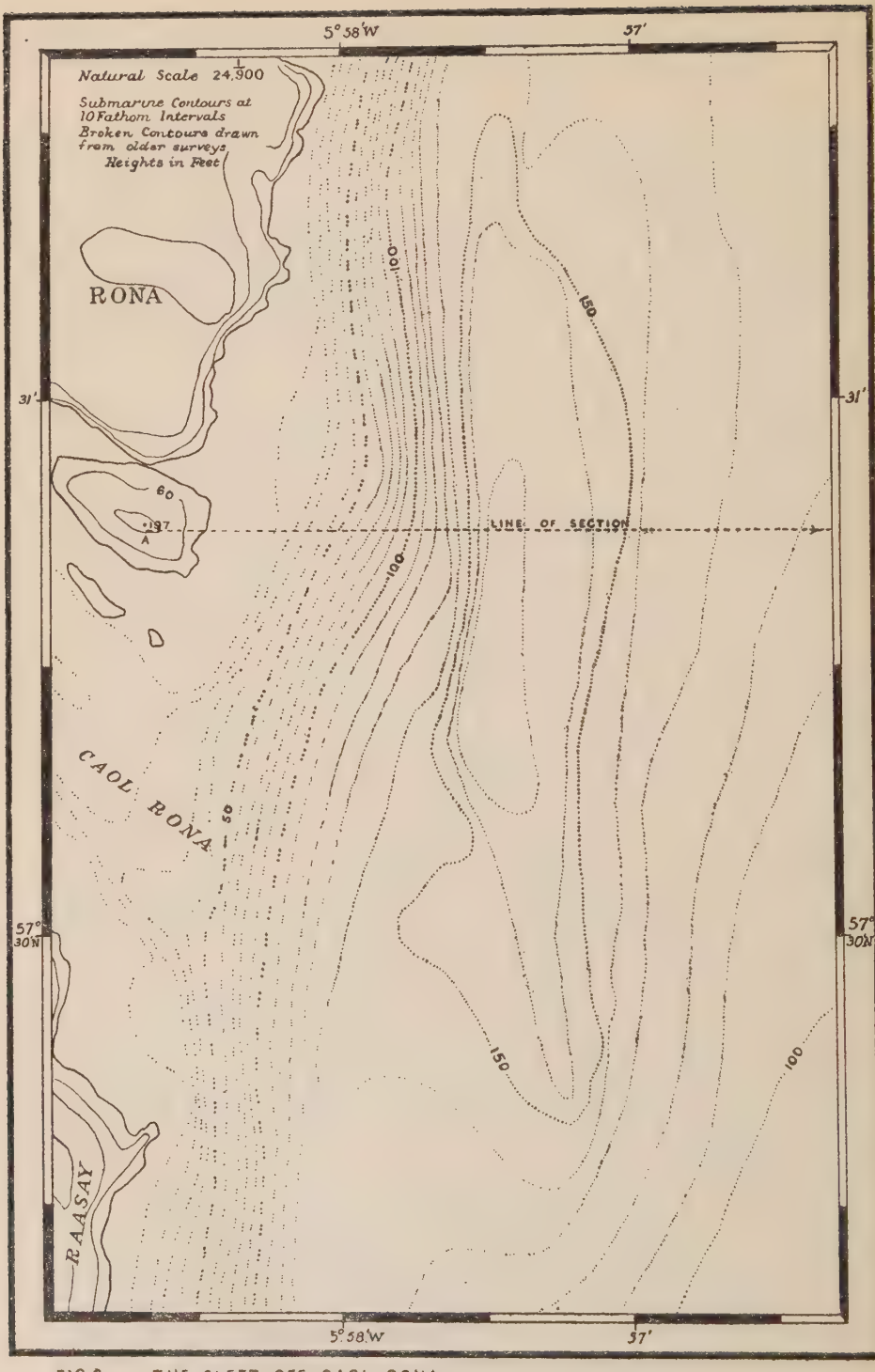


FIG 2. THE CLEFT OFF CAOL RONA

There is very little evidence of the nature of the sea bed in the area of the trenches. Samples of the bottom taken during the Linne Crowlin survey all consist of mud, but this may well be only superficial.

These precise surveys may be considered to throw some light on the controversial subject of the origin of fjords. Without seeking to support one school of thought at the expense of the other, consideration may be given to the position and form of the clefts in their relationship to the known tectonic features and recent geological history of the surrounding country.

The area of the Inner Sound is traversed by a number of important dislocations. The One Inch Geological Map of Scotland (Sheet 81) shows a fault crossing Raasay from north of Holoman on the west coast to Screapadal in the east, where it runs out to sea. It is probable that this line of weakness continues under the deeper half of the Sound, as suggested by Peach and Horne. The axis of the deep-water cleft may possibly be coincident with this line. The asymmetrical nature of the form is suggestive of a fault with the upthrow represented by the steep western face and the more gently sloping downthrow by the area to the east of the axis. The fault when traced on the island of

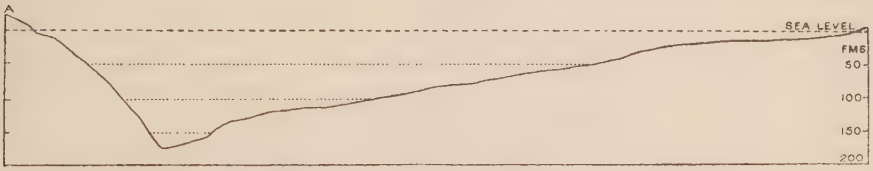


Fig. 3. Section across the Inner Sound in the latitude of the cleft of Caol Rona. Vertical exaggeration = 2·9.

Raasay has an estimated throw of about 1000 feet, a figure which is in harmony with the magnitude of the submarine feature.

The local overdeepening which the cleft represents is more difficult to explain. Gregory, in discussing the origin of the deep in Loch Morar, suggested that it occurred at the intersection of three lines of weakness. The hole resulted from the crushed and weakened rocks at the junction being easily removed by denudation. Following this line of reasoning, it might be argued that a line of weakness with its associated rifting lies along the strait of Caol Rona separating the islands of Rona and Raasay. This north-west to south-east line would intersect the Inner Sound fault in the vicinity of the deep.

There is no direct evidence of any line of weakness in Linne Crowlin. A fault also runs from south-east to north-west across the island of Scalpay, but, as it only affects Torridonian rocks, no estimate is given of its throw.

An alternative explanation of such isolated deeps emphasises the importance of differential ice erosion. During at least one stage of the Ice Age, ice moved along the Inner Sound, which, according to Ting, had existed as a prominent pre-glacial valley carrying a large north-flowing river. The direction of movement, as shown by the evidence of glacial striae on Raasay, Rona and the adjacent mainland,

FIG 4. THE HOLE IN LINNÉ CROWLIN

was from south to north. In addition to being an outlet for the main ice sheet, this area was probably fed by local ice from the Cuillins. Ting asserts that it is this combination and also the limited space between the Crowlin Islands and Scalpay which has caused the over-deepening in the Inner Sound.

Whatever the merits of the two explanations, it is obvious that the tectonic theory must take some account of such a recent geological episode in explaining these deeps ; the problem resolves itself into one of relative degree of effectiveness.

The clefts in the Inner Sound are probably not unique. Within the whole area of the seaboard off western Scotland there is evidence that many such features may exist. Knowledge of the greater part of the area is restricted to information from old surveys with their sparse distribution of soundings. It is only with large-scale surveys using modern methods that a full assessment could be made of the submarine features of the region.

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## ASSYNT PARISH

By Peggie M. Hobson

Il y a fort peu d'habitans en Assynt à cause de la pauvreté du pays.
Blaeu's Atlas, 1654.

Assynt, the most southerly of the west-coast parishes of Sutherland, is bounded by natural features on every side ; by the sea to the north and west (Point of Stoer 58° 16′ N., 5° 24′ W.), by high mountains to the east, and by a river, lochs and hills on its southern margin where it marches with the county of Ross and Cromarty. The area of the parish is 110,091 acres and it measures approximately twenty-six miles from east to west and twenty-two from north to south on its longest axes. It has for long been a favourite haunt of the angler, the climber, the geologist and the naturalist, and historically, too, it has much of interest to offer. There are the remains of duns, hut circles and old graveyards in the north, there is a broch beside the sea at Clachtoll, Stoer, and in the mountainous interior there are numerous cairns and some famous caves. In Assynt churchyard there is the burial vault of the Macleods of Assynt : on the shore of Loch Assynt

near by are the ruins of Ardvreck Castle, the scene of the betrayal of Montrose, and of the newer White House (Calda House) built in the seventeenth century by the Mackenzies who succeeded the Macleods as Lairds of Assynt.

## Relief and Structure

Some of the wildest scenery in Scotland is to be found within the parish of Assynt ; the mountains are encircled by cliffs, gullies or screes ; the hollows are filled with lochs or bogs, and the plateaux are often dissected by narrow steep-sided ravines. The eastern half of the parish is truly mountainous with steep slopes, very rough surfaces and several peaks of over 2500 feet ; little of the western part is much over 500 feet, but the higher land reaches the coast and thus slopes are steep and the surface exceedingly broken.

Four relief divisions can be distinguished (see Figs. 1 and 2) :

*The Eastern Mountains*, lying to the east of the Loanan River and Loch Assynt, are all within the belt of complication and relief varies greatly according to the detailed geological structure.

*Glencanisp Forest*, a broken upland area, is characteristic of the dyke intruded gneiss except where cappings of Torridonian sediments stand up as isolated mountains—*e.g.* Suilven and Canisp.

*The Foreland proper*, the coastal and northern section of the Lewisian gneiss, is similarly broken and hummocky with much bare rock and numerous lochs.

*Rhu Stoer*, a peninsula of Torridonian sandstone, has a more gently undulating surface and a more continuous cover of drift than the gneiss ; its coastal cliffs are precipitous.

The rivers of Assynt are short and swift flowing, but as they have extensive catchment basins and drain many large lochs, they could undoubtedly provide an abundance of water for general use and for power. The main rivers are the Inver and the Kirkaig, but the whole drainage pattern is irregular and confused : the Ledmore area must once have drained to Loch Assynt, and it is probably only since glacial times that the lochs in the south have been drained by the Kirkaig. Throughout the parish the effects of glaciation have greatly interfered with the normal drainage ; wide U valleys are lacking except in the Loanan valley and the Loch Assynt basin, but there are countless lochs, bare rock surfaces, stretches of boulder-clay and pockets of drift.

The coastline is long, indented and very varied, consisting of cliffs, sandy bays, sheltered inlets and deep fiord lochs. The main sea lochs are Lochs Kirkaig, Inver, Roe, Nedd, Ardvar, Cairnbawn and Glendhu and Glencoul above Kylesku. There are wide sandy bays at Achmelvich, Clachtoll and Stoer on the west and again at Clashnessie on the north. Elsewhere there are cliffs, lofty and vertical, in the Torridonian areas but more rounded and gentle in the regions of gneiss. There are several islands and islets off shore; some are used for grazing, but not even Oldany is inhabited to-day.

The outstanding feature in the geology of Assynt is the evidence for powerful thrust movements which drove great masses of rock in a general WNW direction ; the Moine thrust, the most easterly of the three major lines of disruption, separates the Assynt region from the

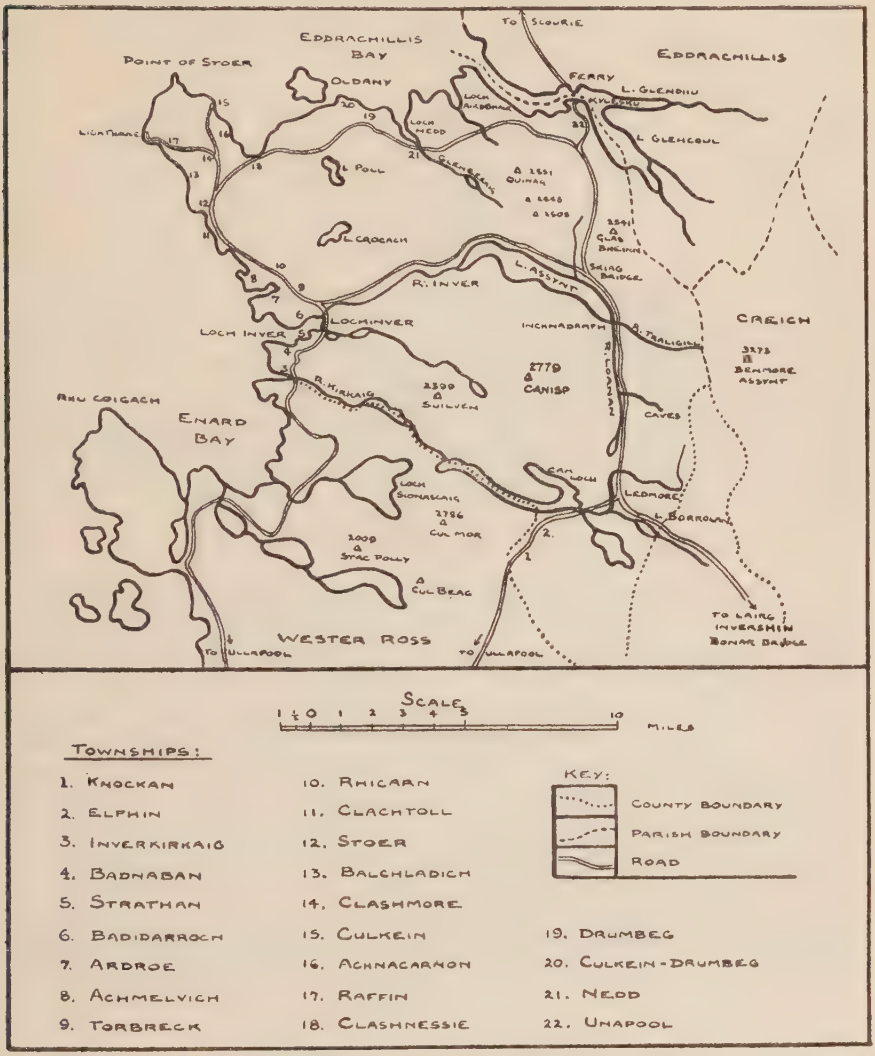


Fig. 1. Assynt : Townships.

more uniform moorlands on the Moine schist series. Large quantities of intrusive material also exist in Assynt, mainly in the Lewisian areas but also associated with the Cambrian outcrops.[1]

It was in this district that Drs. Peach and Horne carried out many of their investigations, and a simple monument, which was erected to them at Inchnadamph in 1930, bears the following inscription :

TO
BEN H. PEACH
AND
JOHN HORNE
WHO PLAYED THE FOREMOST
PART IN UNRAVELLING THE
GEOLOGICAL STRUCTURE
OF THE
NORTH WEST
HIGHLANDS
1883-1897
AN INTERNATIONAL TRIBUTE
ERECTED 1930

Some very interesting remains were discovered by Drs. Peach and Horne in 1899 in some caves above the Allt nan Uamh, three miles SSE of Inchnadamph. These caves were excavated and further explorations were made in 1926.[2, 3] The animal remains found show the only suggestion of a continuous faunal succession so far discovered in Scotland, and they range from an Arctic fauna, through a predominantly reindeer fauna, to the remains of more recent Scottish animals.

## Climate

Variations in surface relief and a westerly exposure give Assynt a more genial climate than the north coast of the county. Climatic conditions are by no means uniform and there are exposed headlands, some sheltered corners and a few patches of woodland. Rainfall totals are very variable throughout and the interior and the coast have entirely different climates (Fig. 3). The temperature and rainfall conditions are typical of a truly maritime west coast climate; the precipitation is heavy with an autumn and winter maximum and the temperature range is low (Fig. 4). The wind rose for Scourie—in Eddrachillis parish—shows a prevailing south-west wind as at Cape Wrath.[4] Prolonged periods of frost are rare, as is snow, but the strong winds, the high humidity and the large number of rain days in the year, as well as the lack of sunshine and the extreme variability of the climate, are a very serious handicap to all agricultural pursuits.

## Settlement and Population

In Sutherland the early nineteenth century was a period of revolutionary change: sheep farming was introduced, the clearances were at their height, communications were vastly improved and the county became a stronghold of the Cheviot breed of sheep. The achievement of this rapid "progress" was accompanied, indeed accomplished, by the removal of the people to poor coastal townships which soon became congested and very poverty-stricken. Towards the end of the century there was a setback in sheep farming and much of the land was turned

over to deer. The land now is still used in the same three ways, namely, for crofting, for sheep farming, and for sport. All the crofting townships, with the exception of Elphin and Knockan, are now situated on the coast, but in pre-clearance days there were roads and paths to many inland settlements, of which virtually no trace remains to-day.

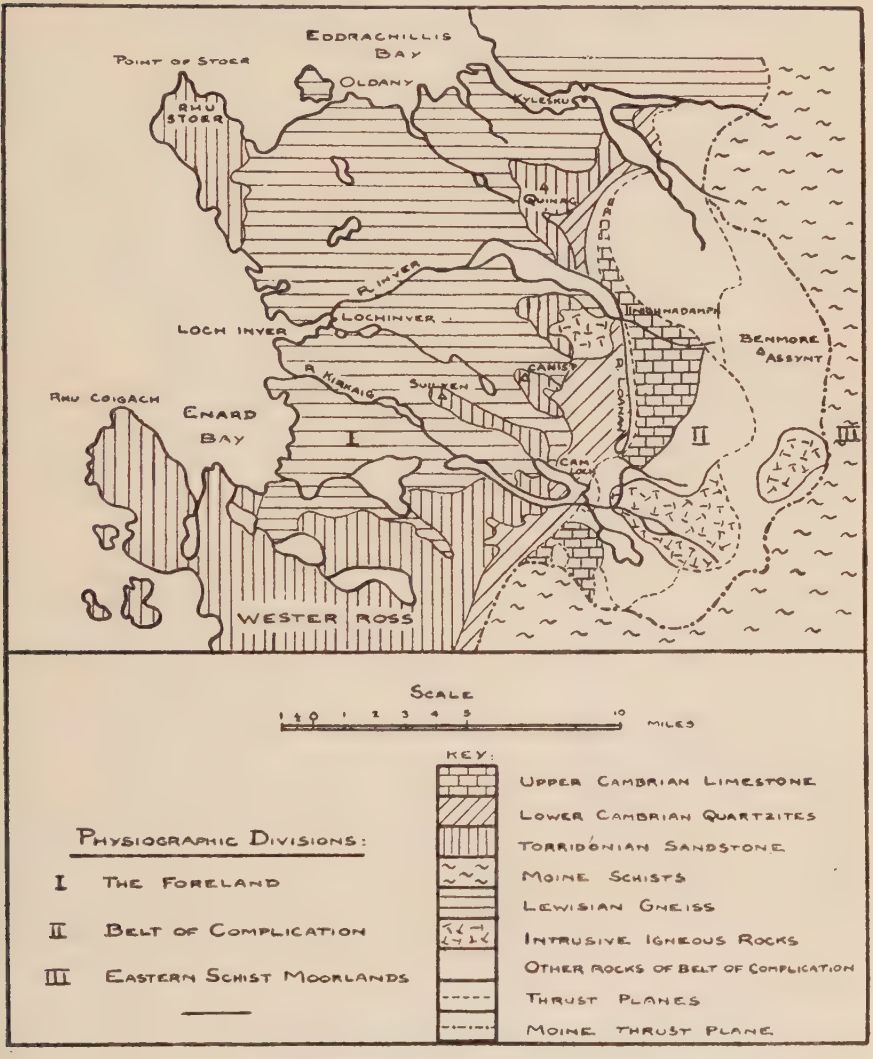


Fig. 2. Assynt: Geological sketch map.

The farms and roads of the interior of the parish were described in the Old Statistical Account for Scotland.[5] The best road linking the coast with the heights of the parish followed approximately the same line as the present one, but there were also well-used tracks from Inverkirkaig via the Cam Loch to Ledbeg and another between Suilven and Canisp leading in the same direction. From Tumore,

on the north side of Loch Assynt towards its western end, a road led to Glenleraig and thence to the north coast. Along these tracks there were occasional herdsmen's houses and wintering places—cattle

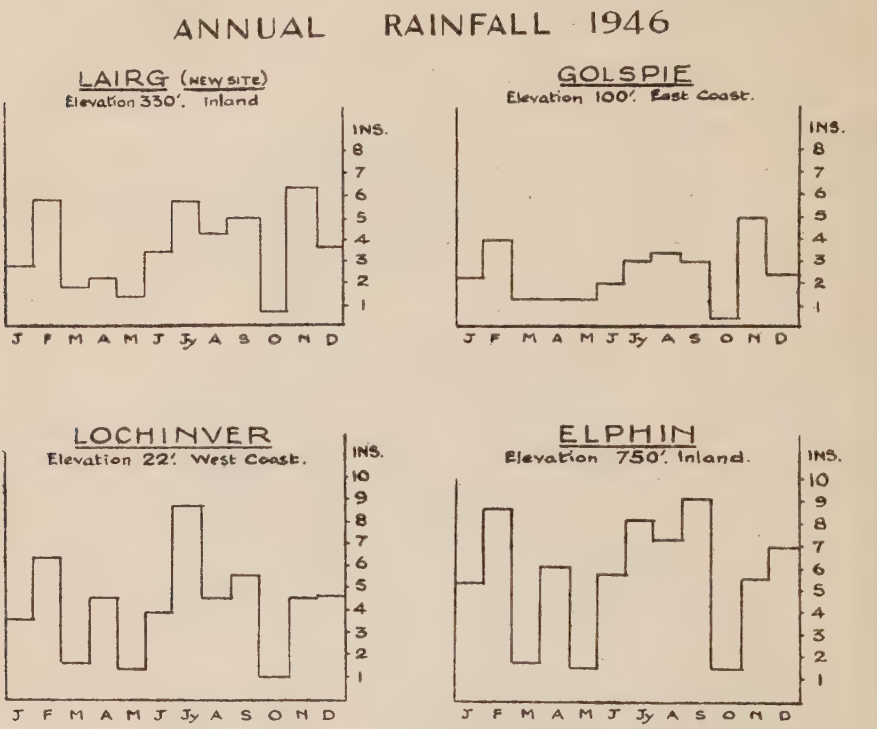


Fig. 3. Annual rainfall, 1946, at Lairg, Golspie, Lochinver, and Elphin.

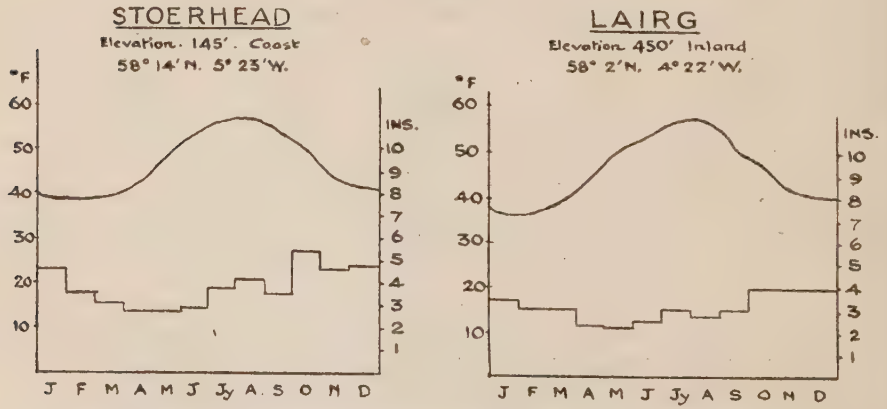


Fig. 4. Temperature and rainfall (1856-1895 average) at Stoer and Lairg.

rearing was the only possible agricultural pursuit in the interior of the parish—but on both shores of Loch Assynt and following the line of the present road from Inchnadamph to Altnacealgach there were numerous farms or winterings belonging to them.

The inland parts of the parish contain sheep farms and deer forest land, on which sheep are also grazed at the present time. Assynt is no longer part of the Sutherland estate : the parish now consists of three estates—one between Loch Assynt and Kylesku, another between Inchnadamph and Glencoul, and the third, a very large estate, occupies the remainder.

In 1861 the population of Assynt was 3178 ; since that time it has declined continuously, and by 1946 it had dropped to 945. This alarmingly low figure represents an entirely unbalanced population, especially in the crofting areas where there are many old age pensioners, numerous elderly bachelors, very few young people, and in some townships no children at all. Lochinver is a village of only 200 inhabitants (1948 estimate), but unlike the rest of the parish it has increased in population since the 1931 census was taken, following the urbanising trend of the whole of the country. Figures for the west Sutherland parishes and the details for Assynt are given below—maxima in *italics* :—

| *Year* | DURNESS | EDDRACHILLIS | ASSYNT | SUTHERLAND |
|---|---|---|---|---|
| 1755 | 1000 | 869 | 1934 | 20774 |
| 1801 | *1208* | 1253 | 2395 | 23117 |
| 1811 | 1155 | 1147 | 2479 | 23629 |
| 1821 | 1004 | 1229 | 2803 | 23840 |
| 1831 | 1153 | *1965* | 3161 | 25518 |
| 1841 | 1109 | 1699 | *3178* | 24782 |
| 1851 | 1152 | 1576 | 2989 | *25793* |
| 1861 | 1109 | 1641 | *3178* | 25246 |
| 1871 | 1049 | 1530 | 3006 | 24317 |
| 1881 | 987 | 1525 | 2781 | 23370 |
| 1891 | 960 | 1409 | 2551 | 21896 |
| 1901 | 870 | 1418 | 2386 | 21440 |
| 1911 | 835 | 1245 | 2111 | 20179 |
| 1921 | 610 | 1131 | 1755 | 17802 |
| 1931 | 529 | 967 | 1342 | 16101 |
| 1946 | 352 | 769 | 945 | 14400 ? |
| 1947 | 408 | 771 | 997 | ? |

ASSYNT PARISH

| | 1931 | | | 1946 | | |
|---|---|---|---|---|---|---|
| | OVER 14 YRS. | UNDER 14 YRS. | TOTAL | OVER 14 YRS. | UNDER 14 YRS. | TOTAL |
| Crofting townships . | 793 | 153 | 946 | 521 | 102 | 623 |
| Other areas . . | 118 | 32 | 150 | 95 | 31 | 126 |
| Lochinver village . | 108 | 44 | 152 | 125 | 36 | 161 |
| Inver . . . | 49 | 16 | 65 | 28 | 7 | 35 |
| TOTAL . . | 1068 | 245 | 1313* | 769 | 176 | 945 |

* This figure is lower than the census figure as only permanent residents have been included.

ASSYNT : CROFTING TOWNSHIPS

| TOWNSHIPS | 1931 | | | 1946 | | |
|---|---|---|---|---|---|---|
| | OVER 14 YRS. | UNDER 14 YRS. | TOTAL | OVER 14 YRS. | UNDER 14 YRS. | TOTAL |
| Knockan | 38 | 4 | 42 | 17 | 4 | 21 |
| Elphin | 50 | 17 | 67 | 30 | 8 | 38 |
| Inverkirkaig | 35 | 12 | 47 | 26 | 0 | 26 |
| Badnaban | 14 | 3 | 17 | 14 | 0 | 14 |
| Strathan | 41 | 11 | 52 | 20 | 2 | 22 |
| Badidarroch | 27 | 2 | 29 | 19 | 6 | 25 |
| Ardroe and Glenroe | 15 | 2 | 17 | 4 | 0 | 4 |
| Achmelvich | 43 | 7 | 50 | 20 | 4 | 24 |
| Torbreck | 16 | 2 | 18 | 11 | 0 | 11 |
| Rhicarn | 9 | 3 | 12 | 9 | 0 | 9 |
| Clachtoll | 66 | 7 | 73 | 40 | 7 | 47 |
| Stoer | 46 | 5 | 51 | 40 | 6 | 46 |
| Balchladich | 21 | 4 | 25 | 15 | 2 | 17 |
| Clashmore | 52 | 7 | 59 | 31 | 8 | 39 |
| Culkein-Achnacarnon | 51 | 18 | 69 | 40 | 16 | 56 |
| Achnacarnon | 31 | 3 | 34 | 23 | 2 | 25 |
| Raffin | 23 | 2 | 25 | 10 | 5 | 15 |
| Clashnessie | 47 | 11 | 58 | 32 | 4 | 36 |
| Drumbeg | 51 | 5 | 56 | 33 | 3 | 36 |
| Culkein-Drumbeg | 54 | 12 | 66 | 37 | 3 | 40 |
| Nedd | 34 | 5 | 39 | 31 | 8 | 39 |
| Unapool | 29 | 11 | 40 | 19 | 14 | 33 |
| TOTAL | 793 | 153 | 946 | 521 | 102 | 623 |

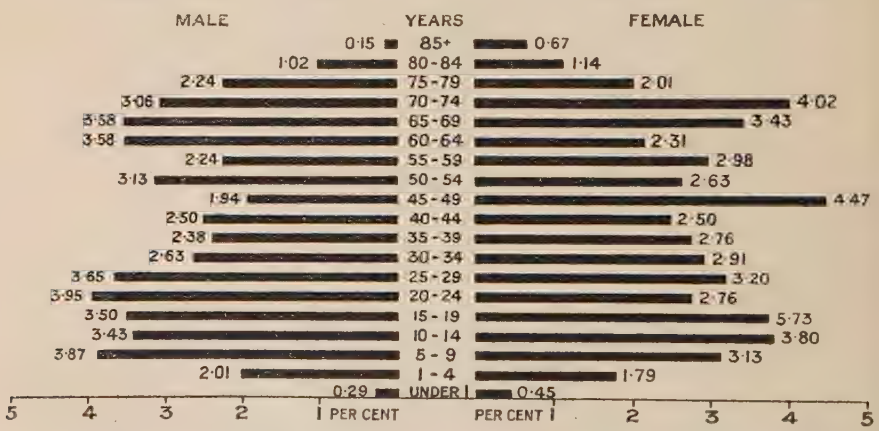


Fig. 5. Assynt Parish. Population pyramid, 1931. Numbers of persons shown as percentage of total population (1342).

## CROFTING

Assynt is essentially a crofting area with all her townships on the coast except for Elphin and Knockan, which are situated on the Durness Limestone several miles inland. The township is the unit for communal

LOCH INVER (N) LOCH GIDH ACHILLA AND MANSE LOCH—(S) LOCHINVER AND CULAG

INCHNADAMPH: (NW) LOANAN AND TRALIGILL ENTERING LOCH ASSYNT—
(SE) BLAR NAM FIADHAG

purposes and each one is fenced off from the Common Grazings : each croft is a separate entity but not all are individually fenced. Most of the holdings are very small, a few of them are vacant and in several cases two or more crofts are worked by one tenant. The total number of holdings in the parish is 370 and of those 284 are of less than 5 acres in extent ; within the crofting townships there are 349 holdings. The croft rents average between £2 and £3 per annum, but at Elphin and Knockan, where the holdings are larger, the figure is between £4 and £6. The rateable value of crofts is one-eighth of the rental and thus rates and taxes cost the crofter very little.

In 1931 the Assynt townships were revalued by the Scottish Land Court.[6] Fair rents were fixed, the original soumings were adjusted and the crofting practices in each township were investigated fully. In most cases the Land Court reported that the administration of the grazings had been slack in respect of drainage, heather burning and sheep management, but that although the sheep were generally in poor condition, the cattle were very good. In Elphin and Knockan, however, the sheep stocks had for long been managed in an exemplary manner and the crofters were accordingly commended by the Court. The table below gives examples of individual crofts from different townships.

| TOWNSHIP : One Croft at | INVER-KIRKAIG | ACHMELVICH | STOER | CULKEIN-ACHNA-CARNON | NEDD | ELPHIN |
|---|---|---|---|---|---|---|
| HOLDINGS IN INDIVIDUAL OCCUPANCY : | | | | | | |
| *Arable :* | | | | | | |
| Acres | 2 | 2 | 5 | 5 | 2 | 3 |
| Roods | 0 | 2 | 0 | 0 | 1 | 3 |
| Poles | 28 | 8 | 1 | 17 | 6 | 21 |
| *Outrun :* | | | | | | |
| Permanent pasture or meadow : | | | | | | |
| Acres | 3 | 17 | 2 | 0 | 12 | 1 |
| Roods | 2 | 3 | 0 | 2 | 3 | 1 |
| Poles | 16 | 30 | 2 | 23 | 28 | 9 |
| COMMON PASTURE: | | | | | | |
| *Township grazing :* | | | | | | 280 |
| Acres | 813 | 730 | 1334 | 788 | 811 | 3613 |
| Share | 1/17 | 1/25 | 1/20 | 1/25 | 1/15 | 1/14, 1/19 |
| *General common :* | | | | | | |
| Acres | 702 | 1205 | — | — | — | 880 |
| Share | 1/28 | 1/22 | — | — | — | 1/35 |
| FAIR RENT : | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| First : 1888 | 3 9 5 | 3 19 6 | 2 10 0 | 3 1 4 | 3 0 0 | 6 12 6 |
| 1931 | 3 2 0 | 3 19 6 | 2 10 0 | 3 1 4 | 3 0 0 | 6 12 6 |
| 1944 | 3 2 0 | 3 19 6 | 2 10 0 | 3 1 4 | 3 0 0 | 6 12 6 |

The arable acreage is very small and the few crops grown—hay, oats and a few turnips—are for feeding to stock ; potatoes form the main crop for human consumption. Tractors are now used for ploughing some of the land, especially for ley ground, and they have proved very beneficial here, as labour is scarce and the climate most uncertain. The land is fertilised by the use of farmyard manure, with artificial fertilisers and, in a very few places, with seaweed ; supplies of seeds and fertilisers are often bought jointly for a township by the Grazing Committee or by a local representative or merchant.

The livestock, grazed mostly on the common pasture, consists of cattle, sheep, poultry, and a rapidly declining number of horses. One or two cows are kept on each croft, but the district is not self-supporting for milk and in winter it is often scarce ; milk for Lochinver arrives on the evening bus from Lairg. Shorthorn-Aberdeen Angus crosses are the most usual breeds of cattle ; a few Ayrshires have been introduced recently. Bulls and rams are generally supplied by the Department of Agriculture, but if a township wishes to purchase its own, it will receive a grant for this purpose. Calves are sold when two or three weeks old at Dingwall, where they fetch high prices ; heifer calves are also sold unless being reared for replacement stock. There is plenty of summer grazing on the hill pasture, but there is very little feeding for cattle during the winter. Sheep are the main source of income ; they can be kept on the hill practically throughout the year, and, as most crofters have the grazing of more than one holding, flocks of 50 or more are not uncommon. The Cheviot breed is kept throughout, but there are Black Faced flocks also at Drumbeg and at Stoer. As on the sheep farms the lambs are sold in August, but very few of the sheep are sent away for wintering. The extent of the Common Grazings is very considerable, consisting of township grazings and enlargements : the souming varies according to the extent and quality of the pasture, and throughout this parish it is expressed as numbers of sheep per share of the grazings. A part of the deer forest is also grazed by crofters' sheep : this is the practice in the Inverkirkaig district. Poultry are kept for local use only, but surplus eggs are sold to the vans or are sent away by post.

Within the crofting areas agriculture is for subsistence, not for commercial purposes : the crofters derive very considerable assistance from Government grants and subsidies, as the grazing land is hill grazing and all the agricultural land is classified as marginal. Thus in addition to acreage payments for arable crops and subsidy payments for stock, the Highland crofter may take advantage of schemes for the improvement of hill farming land and for the assistance of marginal agricultural production. The acreage payments are (1948) : £8 per acre for potatoes, £3 per acre for wheat and rye (not grown in Assynt), and £4 per acre for ploughing up grassland for the current year's harvest. Subsidy payments are made for hill sheep (16s. for breeding ewes and gimmers), for hill cattle (£7 for breeding cows and in calf heifers) and for calves reared to the age of one year (£4 for steers, £3 for heifers). There is also an agricultural lime subsidy (maximum contribution 14s. per acre), a subsidy scheme for the destruction of

rats and rabbits by gassing, grants in aid for the eradication of bracken and schemes for the assistance of agricultural water supplies and agricultural drainage. Financial assistance is available towards the cost of comprehensive improvement schemes to hill farms (Hill Farming Act, 1946) and the scheme for the assistance of marginal agricultural production is operated by the Agricultural Executive Committee. In this district, under this scheme, grants of up to 50 per cent. of the actual cost will be paid for fertilisers, provided that sound cultivation standards are observed.

A croft can provide a home at a reasonable cost but it cannot provide a living, and the younger members of a family must go away in search of work. Under existing economic conditions and with our present standard of living, it is not possible for the poor lands of the north-western seaboard to support the population which they once maintained. Young people will no longer settle where there is no transport, where the houses are not modernised, and where they are a day's journey from the nearest town. Accessibility and comfort, however, are not all, and with some improvement in conditions, with a chance to acquire a holding of a reasonable size, and with the prospect of other types of employment, the area may in time repopulate itself.

The crofting mode of life breeds independence and pride, but these fine qualities may be undermined if the artificial economy of to-day is continued for too long, and the excessive degree of security which the crofting tenure affords may serve to encourage indifference and to eliminate progress.

AGRICULTURAL STATISTICS : ASSYNT

| | 1938 | 1945 | 1946 | 1947 |
|---|---|---|---|---|
| LIVESTOCK (Numbers) : | | | | |
| Horses | 111 | 88 | 80 | 74 |
| Dairy cattle | 473 | 434 | 484 | 433 |
| Beef cattle | 50 | 49 | 61 | 14 |
| Sheep | 19,785 | 26,324 | 26,416 | 20,668 |
| Pigs | 11 | 3 | 3 | 4 |
| Poultry | 4,262 | 5,479 | 5,149 | 4,898 |
| CROPS (Acres) : | | | | |
| Barley | 8 | ½ | ½ | 1 |
| Oats | 347 | 228 | 209 | 221 |
| Potatoes | 120 | 72 | 63 | 65 |
| Turnips | 6 | 7 | 4 | 4·5 |
| Rotation grasses | 213 | 179 | 173 | 141 |
| Permanent grasses | 1,430 | 986 | 1,040 | 1,039 |

## THE ASSYNT TOWNSHIPS

The general characteristics of crofting in Assynt hold good throughout the parish but there are local variations, and it is possible to consider the townships in several groups :

| AREA | TOWNSHIPS | NUMBER OF HOLDINGS | POPULATION |
|---|---|---|---|
| Elphin | Elphin, Knockan | 38 | 59 |
| Kirkaig | Inverkirkaig, Badnaban, Strathan | 42 | 62 |
| Lochinver | Badidarroch, Ardroe, Torbreck, Achmelvich, Rhicarn | 47 | 73 |
| Stoer | Clachtoll, Stoer, Clashnessie | 73 | 129 |
| Rhu Stoer | Balchladich, Clashmore, Culkein-Achnacarnon, Achnacarnon, Raffin | 85 | 152 |
| Drumbeg | Culkein-Drumbeg, Drumbeg, Nedd | 55 | 115 |
| Kylesku Ferry | Unapool | 9 | 33 |
| | Total | 349 | 623 |

*Elphin.* Elphin and Knockan are isolated townships ten miles inland and 500 feet above sea-level. They are almost entirely dependent on crofting. Their population, consisting of a large proportion of elderly people, is declining very rapidly, and the area is becoming derelict. The Durness Limestone on which the townships are situated provides good meadow hay and some excellent pasture land for sheep. The crofts are slightly larger than the coastal ones, but the heavy rainfall and the lower temperatures make harvesting both late and very precarious. The open arable strips are grouped together and are thus very suitable for cultivation by tractor. Cheviot sheep are the main source of income and several crofters have flocks of 50 sheep or more : this is made possible by working two or more holdings, and only in this way is it possible to make a living from a croft. Some of the sheep, the ewe lambs in particular, must be sent away from here for wintering.

*Kirkaig.* The Kirkaig townships concentrate almost exclusively on sheep and, in addition to their common grazings and enlargements, they graze sheep on 30,000 acres of the adjacent deer forest. Very few cattle are kept, as there is no winter keep for them and hay has to be brought in from a distance. Rabbits preclude the growing of almost all arable crops, except potatoes. Lobster fishing is an additional source of income, and the tourist industry would develop considerably if transport facilities were available.

*Lochinver.* Lochinver itself is a non-crofting community, but within a few miles of the village are the scattered townships of Badi-

darroch, Ardroe and Torbreck. The few holdings in these small townships are well sheltered by hills and by trees. They are declining in population, and they are no longer dependent exclusively on crofting and on fishing. Many years ago, Inver Farm was divided to provide additional grazing land for Badidarroch, which was also granted a part of the Glencanisp deer forest as an enlargement. Ardroe, which can only be reached by footpath or by boat, once held sixteen familes ; to-day its population is four. Achmelvich, a larger and more scattered township, once had its own school, but this has been closed for several years.

*Stoer.* In the Stoer townships, the surface is composed of sand or of rock. Clachtoll is rapidly becoming buried in sand, cultivation is becoming increasingly difficult and rabbits have become a serious menace. Potatoes and some barley are the main crops on the sandy land ; good crops of oats and grass are being grown on patches of tractor ploughed ley ground which are further inland and have a blacker soil. Stoer itself acts as a small village centre and the proportion of its non-crofting population is increasing.

*Rhu Stoer.* In Rhu Stoer, the Torridonian Sandstone, on which the townships are situated, gives rise to a bleak, open landscape with undulating surfaces and much badly drained land. Culkein, with a good pier and with excellent facilities for lobster fishing, is the most prosperous township. Clashmore, once a farm, was divided into small holdings in the early part of the present century. Achnacarnon has an exceedingly stony soil and Raffin suffers from drainage difficulties. Lack of transport is a handicap to these townships, but all are now being provided with excellent roads.

*Drumbeg.* The north coast of Assynt is characterised by steep slopes, by patches of woodland and scrub and by deep, sheltered inlets. There is very little land suitable for cultivation, but fishing is an important occupation here. Isolation is the main handicap : Drumbeg, the village centre, is fourteen miles from Lochinver and eleven from Kylesku Ferry ; its only transport is the Lochinver mail car, as the ferry road is exceedingly steep, winding and narrow, and it carries very little traffic.

*Unapool.* Unapool, an isolated township on Loch Glencoul, depends on the sea as well as the land, but lobster fishing cannot be carried on above the Kylesku narrows. Cultivation is exceedingly difficult and much of the arable land, which consists mainly of patches throughout the outrun, can only be worked by the spade. There is no transport to Unapool, and even lonelier is Kerracher, a solitary holding on Loch Cairnbawn, worked by a crofter fisherman.

## Sheep Farming

The Cheviot breed of sheep was introduced to Sutherland in 1806, and since that time hill sheep farming has been the mainstay of agriculture in the county. Sutherland is essentially a breeding and a rearing country, as she has vast expanses of hill grazing land but very little arable.[7] In Assynt there are sheep farms at Stronechrubie and

Ardvar—once settled by small-holders—and at Loch Assynt and Glencanisp. In the two latter cases sheep farms have recently been re-established on the deer forest. All are stocked with Cheviot sheep and follow similar hill-farming practices.

Stronechrubie, the largest, is situated on the Durness Limestone which provides excellent grazing land used at all times of the year. The farm is divided into six hirsels—Glenbain, Stronechrubie, Lyne, North Ledmore, South Ledmore and Cromalt—and there are large parks at Ledbeg which were recently added to the farm. Each hirsel, usually the responsibility of one shepherd, carries between 500 and 600 Cheviot ewes (Blackfaced on Lyne), but in 1948 the losses of the previous year have reduced the number to under 400 : the acreage required per sheep is between four and ten according to the pasture. Lambing begins about 20th April ; the lambs are sold in August at Lairg—Blackfaced at Inverness—and the cast ewes at five or six years old, in October. For the three farms of Stronechrubie, Ardvar and Glencanisp about eighty rams are kept : these have to be hand fed in autumn before being put to the hill at the end of November. In January the rams are sent away for wintering but, with the exception of the ewe lambs, all the remainder of the stock is wintered on the hill. There is no arable land on Stronechrubie Farm, and no cattle are kept, except for the shepherds' cows. The main problems which confront the sheep farmer in Assynt are bracken, drainage difficulties, lack of shelter, and the fact that some of the land has been grazed exclusively by sheep for far too long. Hill sheep farms will undoubtedly derive great benefit from the Hill Farming Act, 1946, whereby grants of up to 50 per cent. of the total costs will be made for approved comprehensive improvement schemes. There are already in operation several grants in aid and subsidy payment schemes of which the most useful is the hill sheep subsidy of 16s. (1948) for each breeding ewe and gimmer.

## Fishing

Assynt is best known for the excellence of its angling ; from a commercial standpoint, it has great advantages for all types of fishing. The close proximity to the Minch fishing grounds and the long indented coastline with its sheltered inlets are highly favourable to deep sea fishing ; there is excellent lobster fishing around the rocky shores, which is prosecuted successfully from the Lochinver, Inverkirkaig and Drumbeg districts, and at Clachtoll the Assynt Estate employs six men at the bagnet salmon fishing station. Deep sea fishing was once a very important industry in this district : Lochinver (Culag) and Nedd were herring fishing stations ; a white fishing station for cod and ling was set up for a short time at Culkein-Drumbeg, and the inhabitants were self-supporting for fish which was eaten in large quantities—fresh in summer and salted in the winter. In addition, many of the men worked seasonally from the east coast herring fishing ports, the women and children remaining at home to work the crofts.

Lochinver is now a recognised fishing port, and at the end of the war, herring were landed there and sent away by road. This practice has now ceased, the boats proceeding either to Ullapool or to Loch Clash (Kinlochbervie) where a herring fishing station has been newly established (1948). A few boats at Lochinver and elsewhere are engaged in white fishing but good catches are usually sent away by bus and train ; thus, supplies of fish for the district must come in by the same means but in the opposite direction.

## Industry

Remote districts with a sparse and scattered rural population cannot be considered suitable as large-scale industrial centres, but this does not mean that local resources should be ignored.[8] In Assynt to-day there is virtually no industry of any kind, yet the fishing industry could be much developed, and there are rich deposits of limestone and dolomite, of which the former is urgently needed for the land. There are areas of scrub vegetation around the coast and young coniferous plantations near Lochinver—about 50,000 acres of woodland—but there is no workable timber in the parish and little of the land is considered suitable for afforestation. Exploitation of the peat resources is unlikely to prove a possibility as many of the mosses are small and scattered, the more accessible ones are becoming worked out, peat roads are poor, labour is scarce, and in many households coal has replaced the traditional fuel. The seaweeds around these coasts are unlikely to be required for industrial purposes.

Hand industries have not been established in this district ; the young people go away to obtain work, and the crofters who remain mostly work two or three crofts and keep considerable flocks of sheep. When electricity is provided in the district, this could be used for the establishment of small-scale industries, mainly in Lochinver, dependent on local raw materials derived from sheep and from fish. The coastal areas from Inverkirkaig to Loch Nedd will ultimately be supplied with hydro-electricity from a generating station at Strath Kanaird. A high-voltage electric line will follow the present coastal road, and there will be distributing mains at Inverkirkaig, Badnaban, Strathan, Lochinver, Clachtoll, Stoer, Rienachait, Drumbeg and Nedd.[9]

## Sport

There are many parts of Sutherland which, although useless for agriculture, provide excellent facilities for sport—for fishing, shooting and deer stalking. In pre-war days such sporting properties were let out for high seasonal rentals, they provided a considerable amount of employment locally, and they brought trade and money to the district. During the period 1938-48 the rateable value of the deer forests, shootings and anglings in Sutherland has decreased by over 50 per cent. In Assynt the main sporting centres are Glencanisp, Ardvar, Ledmore and Oldany on the Assynt Estate, and at Loch Assynt and Inchnadamph on the others. There are also hotels, mainly of interest to

anglers, at Lochinver, Inchnadamph, Altnacealgach, Kylesku and Drumbeg. The estates provide some employment throughout the parish; there are keepers, stalkers and watchers on the forest, and a considerable number of people are employed in Lochinver and district as craftsmen or in other ways—for example, in the hotels and shops. Provided it were organised on a 'dollar-earning' basis, there are some who consider that sport is still the best use for land such as this, but under existing conditions (1948) there are throughout the north many empty lodges, many unrented shootings and far too many half-filled hotels.

### The Tourist Trade: Communications and Transport

Assynt already possesses a number of excellent hotels, but it is in the townships that the tourist industry is needed where it could prove a valuable source of income to the crofters. There are some households which have taken visitors or let rooms in summer for several years, but not all are able to do this as only a few have a piped water supply; water schemes for some of the rural areas have been approved, but they have yet to be implemented. Other difficulties confronting the tourist industry at the present time are the lack of transport, the difficulty of obtaining labour, and the severe rationing of food and of petrol.

Most of the roads in Assynt are narrow and winding, some are very steep and the surface is often poor. The only main road is the one serving Lochinver from the east which enters the parish at Altnacealgach. This road and the branches to Unapool and Inverkirkaig were built under the direction of the Duke of Sutherland a little over a century ago. The other roads of the parish lead from Ledmore to Elphin and thence to Ullapool, and there is a road from Lochinver to Kylesku Ferry linking the coastal townships via Stoer and Drumbeg.

At the turn of the century, grants made by the Congested Districts Board did much to improve communications; paths and roads were built or improved, and many grants were made for boatslips and for piers. Assynt benefited greatly from the funds of this Board which also assisted towards the cost of fencing, and supplied rams and bulls for the improvement of stock and seeds for the crops.

In a county as empty as Sutherland, roads constitute a major item of expenditure: over £15,000 must now be provided by the county ratepayers, which means an actual road rate of 6s. per £ or 23 per cent. of the total county rate. Under the Crofter Counties Scheme there is to be a main road right round the county: it will enter Sutherland at Knockan and proceed via Ledmore, Skiag Bridge, Unapool, Kylesku Ferry, Scourie, Laxford and Durness to Tongue and eastwards into Caithness. This road will pass through only three of Assynt's townships, but it is expected that a first-class road will be continued from Skiag Bridge to Lochinver village. The coast road via Drumbeg is to be improved and tarred, and it is hoped that all the work will be completed in five years' time. For parish roads, such

STOER AND CLACHTOLL—ENARD BAY AND COIGACH HILLS

RIVER INVER AND CANISP

RIVER LOANAN AND LOCH ASSYNT

LOCH ASSYNT: LIMESTONE ESCARPMENT (BLAR NAM FIADHAG)

QUINAG AND LOCH ASSYNT

LOCH ASSYNT: INCHNADAMPH AND QUINAG

SUILVEN FROM THE EAST

SUILVEN AND CUL MÓR FROM THE NORTH WEST

as the good road system now being completed in Stoer, the Department of Agriculture provides an 85 per cent. grant and labour is recruited locally. The Department is also supplying money for the improvement of piers and boatslips.

Transport in Assynt is exceedingly limited ; there is a daily mail bus to Lairg from Lochinver, with a connection from Drumbeg, and there is a passenger bus to Invershin. Apart from hired cars, there is no means of transport south of Lochinver nor to the ferry at Kylesku either from Skiag Bridge or from Drumbeg. Goods and supplies are transported by bus, lorry, or sea to Lochinver : the irregularity and the expense are the greatest deterrents to progress.

## Lochinver Village

Lochinver is the only ' urban ' settlement on the north-west coast between Ullapool in Ross-shire and Tongue in the north. The village, backed by rocky hills, is situated on a very narrow ledge between the mouths of the Inver and Culag rivers. These rivers flow into Loch Inver, a sheltered, deep water, natural harbour whose entrance is guarded by Soyea Island. In spite of her small size—200 population —Lochinver is a self-contained community ; it is the centre for the parish, and although it has many of the functions of a small town, there is an insufficient number of people for it to serve. It has a bank —a criterion of urban status—a post office, a telephone exchange, and a large garage which runs the bus services to Lairg and Invershin. The mail is brought by bus from Lairg, and supplies come by road or by sea from Glasgow by a steamer which calls every ten days. The village has a school with over forty pupils, it has a resident doctor and a district nurse, it has its own merchants and craftsmen, the district council clerk's office is there and there is a fire station, a police station, a coastguard station and a workhouse near by. Religion is not neglected in Lochinver for there are three churches: the Church of Scotland, the Free Church and the Free Presbyterian Church—the first and last having resident ministers. There are social activities to suit all tastes, and most functions and meetings are held during the winter months in the village hall. There are branches of the Scottish Women's Rural Institute and of the British Legion ; there are Girl Guides, Brownies and Boy Scouts ; there are several choirs, a dramatic society, a rifle club and a badminton club, and at regular intervals a travelling cinema brings a programme to the village.

The houses are attractive, well built and commodious : they are supplied with water and most of them have electric light ; coal or rural gas are more widely used for fuel than peat. Lochinver has a small tourist trade which, had times been normal, would have reached considerable proportions by now ; it has two hotels frequented mainly by anglers. The district is much visited also by motorists, cyclists, climbers, and hikers.

The cost of living in a small ' urban ' centre such as this is high : rates are high—the county rate is 26s. per £ —and as they are not agricultural subjects, the inhabitants of a village pay full rates ; coal

is expensive, light is expensive, and freight rates are inevitably excessive on all goods brought in from a distance.

Years ago Lochinver was a fishing station, meal was ground and timber was sawn in the Culag mills, and meal, fish and vegetables were preserved and sold to visiting sailors. There is no such employment in Lochinver now although it has many amentities and many advantages, and as a community it could maintain a denser population. It could be most suitably developed as a fishing port, for which it has many natural advantages and also a small but useful pier. As in most places, the housing shortage would prove a hindrance to any developments, but the County Council, anxious to develop the port, has let contracts for the construction of six permanent houses which, owing to lack of space in the village, must be built on the north side of the loch.

The introduction of entirely new types of industrial employment in a rural area may not necessarily prove beneficial to it : the traditional industries should be encouraged and developed, and it is the local natural resources which should be exploited first. If Lochinver is to be developed it should surely be, not as an isolated industrial settlement, but as a focus and centre for an essentially rural parish.

## Conclusion

Assynt is a poor parish : it is remote and inaccessible, it is wild and mountainous, and it has an unfavourable climate and limited natural resources. It was not destined to house busy towns or large-scale industries, and it can never support a great density of population. It cannot be denied, however, that at the present time there is a sense of frustration and despair in Assynt, and already most of the younger people have left the crofting townships, the population has become completely unbalanced, and agricultural progress has become almost impossible owing to the lack of a suitable labour supply. In the village of Lochinver there is no real employment for the people : there are no industries, fishing employs a very small number indeed, and the excellent harbour is practically unused.

Interest in the North West has been aroused recently by the re-settlement schemes announced for the Lairg and Ardgay districts. If these schemes prove successful, then Lairg, as the only central place in the whole of the county, should be developed as a town of a reasonable size and status. This would prove of inestimable benefit to the whole of the North West and it might serve to check the drift of people to the towns. The County Council is fully aware of the alarming situation which exists, and it has submitted a memorandum to the Advisory Panel on the Highlands and Islands which, while deploring the derelict condition of much of the land, puts forward suggestions for development after a careful examination of the existing conditions and of available resources.

When the main roads have been improved, and when electricity and water are available throughout the district, the whole of Assynt parish will derive immediate benefit : but these alone will not provide

employment nor can they support a thriving rural population. Exploitation of the natural resources must proceed simultaneously—there are minerals to be quarried, a fishing industry to be developed and much land which could be improved for agricultural use. Facilities for sport need not be impaired, and there is room, too, for a considerable tourist trade which could prove a very valuable source of income in the crofting townships.

The author wishes to acknowledge her thanks to Dr. F. Fraser Darling, West Highland Survey; to Mr. Thomas Adam, Factor, Golspie; to the officials of the Sutherland County Council; to many residents and officials in Assynt; and to the officers of the Department of Agriculture, the Meteorological Office, the Register House and the Scottish Land Court, Edinburgh, for their co-operation and assistance.

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# THE BRISTOL CHANNEL COASTLANDS: EARLY CULTURAL CONTACTS

By R. M. Prothero

In a paper on "The Early Settlement of Glamorgan," read at the meeting of the British Association in 1935, Mr. T. W. Freeman [1] made several references to the importance of the introduction of cultural elements into that area from the south across the Bristol Channel. It is now evident that this is largely true for the whole of South Wales during the prehistoric period. Reports of excavations carried out in the area during the last thirty years include reference to the existence of cultural contacts of one sort or another between the opposite shores of the Bristol Channel. An attempt, therefore, is made in this paper to correlate such evidence in order to note the main features of these contacts, and to define and explain the major zones of contact. The emphasis throughout is laid on the influence of geographical factors, particularly "the spatial relations of the area [2] in different periods." With this feature uppermost, the study has been based on the major archaeological distributions within and beyond the Bristol Channel coastlands.[3] Unfortunately, lack of space prevents the publication of all the map evidence used.[4] Previous to the arrival of the Megalithic builders the evidence is insufficient for consideration, and only that for the Megalithic, Bronze, and Early Iron Ages has been examined.

It is already well established that cultural movements into Britain in prehistoric times concentrated on two main entries. Across the narrow seas at the eastern end of the English Channel came the invasions whose associated cultures were concentrated for the most part in the Lowland Zone. Navigating the western seaways came the invaders and immigrants who established new cultures which flourished most vigorously in the Highland Zone.[5] The Bristol Channel and its adjacent coastlands occupied a unique position in relation to these movements. Whilst facing the south-western approaches to the British Isles, the Channel penetrates a considerable distance into the mainland of Britain and provides a sea-route from the west linking up with the Severn-Avon valley and the river-valleys of Somerset. The peninsulas of Pembrokeshire and Cornwall, though relatively isolated from the mainland of Britain, occupy a central position on the sea-route between Brittany and Ireland. At the eastern end of the Channel the Cotswold and Mendip Hills are linked with the chalk plateau of Salisbury Plain and the White Horse Hills—the focal area of the Lowland Zone.

From the physical standpoint, a two-fold relief division of the Bristol Channel coastlands may be made—a low-lying region comprising the coastal plain and the valley floors, and an upland hinterland. For the purpose of delimiting these micro-regions the land above 600 feet is termed upland. The lowland is more extensive along the north coast of the Channel than along the south, being almost non-existent where the hills of Exmoor and Bodmin Moor approach the coast. The upland attains a maximum elevation of a little over 2000 feet, with the Cotswold and Mendip Hills comparatively lower in

altitude than the moorlands of South Wales and the granite masses of Devon and Cornwall. At the western extremities, about St. David's and St. Anne's Heads in Pembrokeshire, and Land's End and the Lizard in Cornwall, the coastline is rugged. The older rocks have been eroded into rocky promontories with steep cliffs. Along the remainder of the north and south coasts there are indentations formed by the sunken estuaries of rivers, providing convenient landing points with sheltered anchorages and easy penetration inland along the valley-ways.

Contacts entailed for the most part the transportation of cultural elements from the coastlands on the south of the Channel to those on the north. Movement in this direction was inevitable with the major centres of cultural progress in prehistoric times lying to the south of the British Isles. This direction was maintained with new cultural elements introduced either by way of lowland Britain or along the western seaways. Movements from Ireland provide the most important exceptions to this general trend. During the Megalithic period Ireland played an important rôle in the diffusion of the practice of building great stone tombs in the British Isles. There is very slight evidence that during this period south Pembrokeshire was influenced by movements from Cornwall, but the distribution of monuments in the peninsula (Fig. 1) suggests Ireland as the main source of the colonising movements. This may be assumed on analogy with the distribution of monuments in Brittany where they are concentrated on the south coast, with a much smaller number on the north coast, indicative of their southern origin.[6] A further analogy may be noted in the distribution of Ogham-inscribed stones in Pembrokeshire in the fifth century A.D., since they represent a movement from southern Ireland.[7]

The location in Ireland of copper, one of the raw materials necessary for the manufacture of bronze, resulted in the Early Bronze Age in the export of products of the Irish smiths to southern England by trade-routes across North and South Wales. Probably by some sea-crossing at the head of the Bristol Channel during this period the ' blue stones ' were transported from the Prescelly Mountains to Stonehenge.[8] In the Late Bronze Age socketed sickles and cauldrons similar to those found in the Llyn Fawr hoard, in Glamorganshire, were imported from Ireland up the Bristol Channel and thence by land to the Thames Estuary.[9] Apart from these minor features, associated primarily with the Irish trade, the most significant reversal of the general south-north movement in the Bristol Channel is to be noted in the Late Bronze Age. With the development of trade with Brittany and Ireland, the Vale of Glamorgan became an important focal area. Prosperity is attested by the presence of five hoards of weapons and implements in the vicinity of the Taff-Ely estuary, and of one at Llantwit Major. Cultural progress in this area was sufficiently advanced to allow of the development of a native form of socketed axe.[10] Examples of this type have been found in South Wales as far west as Pembrokeshire and along the south coast to Cornwall.

The transportation of cultural elements across the Bristol Channel from the south resulted either in degenerate examples being found in

the northern coastlands, or in the modification of these elements in response to local custom and tradition. Both features were conditioned by the relatively more remote position of the South Wales coastal plain. Detailed features of fort construction in South Wales during the Early Iron Age reveal close similarities to those noted in Somerset, Devon, and Dorset. For example, the water storage system at the Early Iron Age fort at High Penard promontory, on the south coast of

Fig. 1. The distribution of Megalithic monuments in Pembrokeshire. 600-ft. contour shown. (Based on W. F. Grimes, *Proceedings of the Prehistoric Society*, 1936, 2 (*1*): 111, fig. 4, and Appendix, p. 139.)

the Gower Peninsula, was found to be similar, though on a considerably smaller scale, to that at Maiden Castle, Dorset.[11]

In all the instances, however, the structures are noted to be *more elaborate* on the south than on the north of the Channel. Comment has been made on the more pronounced La Tène character of pottery from the Knave fort, Gower, as compared with material from Llanmelin and Sudbrook in Monmouthshire and Salmondsbury in Gloucestershire.[12] The inference is that *direct* contacts existed between the Gower Peninsula and the lake-village sites at Glastonbury and Meare. The estuaries of the rivers Brue and Parrett are situated only sixty miles away to the south-east.

Several of the Bronze Age barrows excavated in the Vale of Glamorgan well illustrate, in their structure and grave goods, modifications resulting from the influence of local custom and tradition. At Crick, in Monmouthshire, a barrow with an encircling ditch and berm, 8 to 10 feet wide, indicated the presence of the bell-barrow form common in Wessex at this period. In the same structure, there were elements of the western Megalithic heritage of the preceding period, which had remained sufficiently dominant to be incorporated in a new structure inspired by a culture with its centre in the lowland of Southern Britain and imported into South Wales across the Bristol Channel. An example from the Late Bronze Age further exemplifies this feature of modification. At the Golden Mile Barrow, Colwinston, Glamorgan, new and traditional methods were found in combination. Burial after cremation was in a type of pottery common to the Highland Zone, but the urns were arranged beneath the burial mound in a form typical of the Lowland Zone during this period.[13] These two examples illustrate the importance of the location of the Vale of Glamorgan on the fringe of the Highland Zone and at the same time open to cultural influences transported across the Channel from the Lowland Zone. The latter, however, did not at any time reproduce in South Wales a culture complex which was an exact replica of one existing in south or south-western England.

A major feature of the cultural contacts was that, even in their modified form, their influence was largely restricted to the coastal plain in South Wales and in the majority of instances to areas immediately adjacent to the coast. Approximately 70 per cent. of the Megalithic monuments in Pembrokeshire, Carmarthenshire, Glamorgan, and Monmouthshire are sited below the 600-foot contour. A map of the distribution of the massed antiquities of the Middle and Late Bronze Ages (Fig. 2) shows a concentration in the coastal areas, the most notable being about the Taff-Ely and Ogwr estuaries and in the Gower Peninsula in Glamorgan and in the Castlemartin Peninsula in Pembrokeshire. However, in each of the three periods under consideration the upland was penetrated by cultural elements from across the Channel. Penetration took place along the flanks of the valleys, which physically are extensions of the lowland into the upland and as such retain a character differing from the more elevated land about them. The motive of a group of Megalithic long barrow builders for settling on the slopes of the Black Mountains in Brecknockshire remains unexplained, though it is established with a fair degree of certainty that they came from the east of the Severn and penetrated the upland by way of the Usk valley. Conditions were more favourable for movement by way of the valley flanks where the forest cover was probably less dense than on the valley floors. A cairn of the Middle Bronze Age excavated on Mynydd Epynt was shown to be similar in structure and associated ritual with Pond Cairn, Coity, Glamorgan.[14] In the Early Iron Age forts with inturned entrances—a feature of Early Iron Age B culture (see page 52)—were built on the flanks of the Usk and Towy valleys. All the above are isolated examples in their respective periods, and at no time is there evidence of extensive

penetration of the upland by cultural elements from the south which had established themselves on the coastal plain of South Wales.

Having thus briefly referred to some of the features that characterised the cultural contacts existing between the Bristol Channel coastlands in prehistoric times, it remains to outline and attempt some explanation of the zones of contacts, which varied considerably in extent during the three periods for which evidence has been examined.

During the Megalithic period contacts were maintained between the opposite coastlands throughout the whole of the Channel. This statement would appear to suggest a claim for the existence of cultural unity within the area, which however was not the case. Monuments in Pembrokeshire and Carmarthenshire and in the Gower Peninsula differ in structure from those in Glamorgan, Monmouthshire, and Brecknockshire. The latter appear to have been built by people moving across the eastern end of the Channel from Somerset and Gloucestershire:

Fig. 2. The distribution of massed antiquities, including barrows, pottery, weapons, etc., of the Middle and Late Bronze Ages in South Wales. (Based on L. F. Chitty and Cyril Fox: 'Personality of Britain.' 1947. Map C.)

the former are linked with Ireland and, possibly, to some degree with Cornwall. A division between these two zones may be made along a line drawn from Oxwich Point in the Gower Peninsula to Morte Point in Devon. To the west of this line, in the majority of the examples where the evidence remains, the form of the covering mound is round, to the east it is long. A monument at Nicholaston, in the Gower Peninsula, may represent the overlapping of ideas from the eastern and western zones. While the burial chamber suggests affinities with western forms, the covering mound is of the long barrow type.[15] The long barrows have been associated with the Neolithic A camp culture in southern Britain.[16] Those of the Salisbury Plain - Cranbourne Chase area are constructed of earthen rubble, with some evidence to suggest that they originally covered wooden structures corresponding to the Megalithic chambers. This appears to be an example of environmental response in an area where suitable stone was not available for chamber construction. From here they spread northwards, and major concentrations with Megalithic chambers are located on the

Cotswold Hills and in north Somerset, with smaller groups related to them in Monmouthshire, the Vale of Glamorgan, the Gower Peninsula, and the Black Mountains of Brecknockshire. Evidence of relationship is supported by detailed structural similarities and by the similarity between the fragmentary pottery from the South Wales tombs and those from the Cotswolds.[17]

Of major importance is the fact that the culture complexes which produced contacts in the eastern and western zones of the Bristol Channel during the Megalithic period differed considerably in their composition. The particular geographical location of the Gower Peninsula is revealed by the presence within that area of monuments common to both zones.

The succeeding Beaker phase marked a change in the routes by

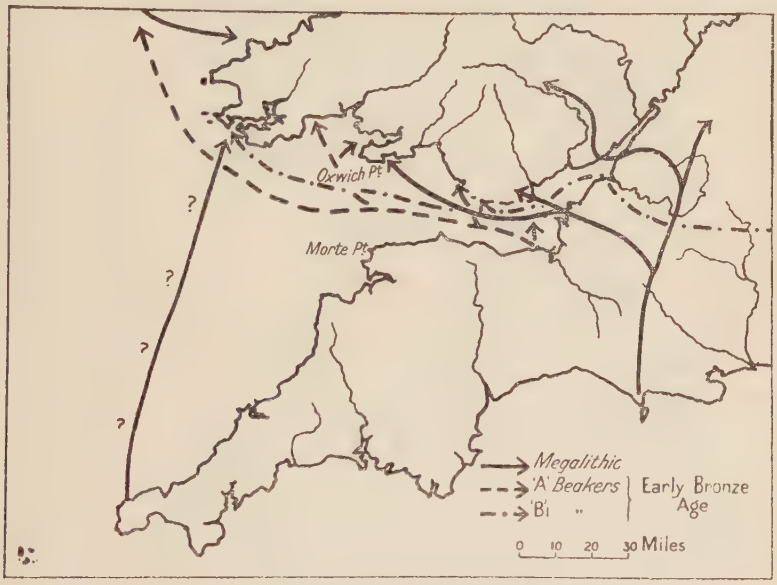


Fig. 3. Bristol Channel coastlands. Cultural contacts: Megalithic and Early Bronze Ages.

which new cultural elements were introduced into Britain. This is evidenced by the general distribution of the Beaker culture.[18] The major invasions responsible for its introduction originated in the Low Countries and in northern France, resulting in the establishment of its main centres in the Lowland Zone of southern Britain. The dominance of the western seaways, which had been a major feature in the Megalithic period, passed away and movement along them became insignificant. In the Bristol Channel coastlands a change in the pattern of the cultural contacts is to be noted. At the eastern end the existence of strong links between the south and north shores is attested by the presence of a considerable number of beakers ('A' group) on the coastal plain of South Wales similar in ornament and shape to beakers from Somerset and Wiltshire. The associated burial ritual—inhumation in a crouched position—is also common to both shores.

There is no evidence during this period of cultural contacts between Cornwall and Pembrokeshire. It is very probable that in the latter area the strength of megalithic tradition was sufficient for that culture to remain dominant. That the Beaker folk penetrated as far west as Pembrokeshire is proved by the presence of a beaker in a barrow at South Hill Talbenny. It is similar to a beaker from a barrow, Sutton 268′, Llandow, Glamorgan. Sir Cyril Fox[19] has suggested a westward movement by sea down the Bristol Channel commencing either from the estuary of the Bristol Avon or from the shores of Weston Bay for this beaker form which is related to the beakers from Wessex. There is further evidence of the use of this route, resulting in the diffusion

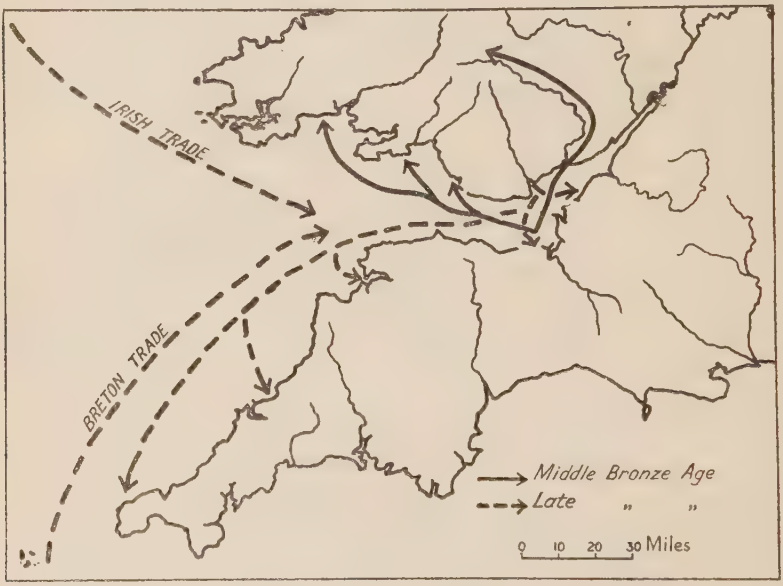


Fig. 4. Bristol Channel coastlands. Cultural contacts: Middle and Late Bronze Ages.

to the western seaways of elements of a culture with its centre in the Lowland Zone of southern Britain. A beaker from Kilmartin, Argyllshire, closely resembles one of the beakers ('A' group) from Wick Barrow, Somerset. More recently Professor S. P. O'Riordain[20] has reported a beaker excavated from the largest of a series of stone circles at Lough Gur, Co. Limerick, "so closely similar to one (an 'A' beaker) from Wick Barrow, Somerset (Childe, 1940, p. 110), that it might have been made by the same person."

The pattern of contacts restricted to the eastern zone of the Channel persisted in both the Middle and Late Bronze Ages, when, for the most part, the major new cultures were introduced into the Lowland Zone and the western seaways remained unimportant. Reference has already been made to the barrow at Crick with its Wessex bell barrow form. No similar material to that found in the Wessex barrows was recovered, and the excavator sees it as representing "an ideological

infiltration from the south preceding the actual migration from that quarter into South Wales." [21]

Evidence of the " actual migration " is to be seen in the results of the excavations of ten barrows in the Vale of Glamorgan, the Gower Peninsula, and Carmarthenshire. All are Middle Bronze Age in date and may be paralleled in barrow structure and grave-goods, or both, with examples from the south side of the Channel in Wiltshire, Somerset, and Devon. Certain of these features may be traced in barrows as far west as Carmarthenshire. All the barrows excavated in South Wales exhibiting them, excepting that on Mynydd Epynt in Brecknockshire, are located in areas immediately adjacent to the coast.

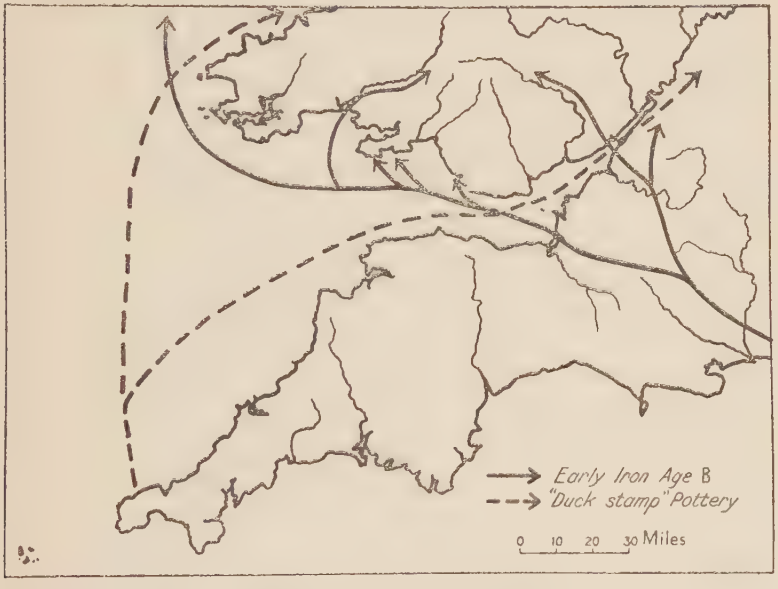


Fig. 5. Bristol Channel coastlands. Cultural contacts: Early Iron Age B —south-western culture.

Contacts were maintained in the eastern zone of the Channel in the Late Bronze Age. They extended as far west as the Gower Peninsula where pottery sherds from Culver Hole Cave, Llangenydd, Gower, are related to forms common in southern England.[22] There are, however, indications in this period of a revival of movement along the western seaways. Two important hoards of Irish gold of the Late Bronze Age have been recovered at Morvah and Towednack in Cornwall, while socketed sickles and cauldrons of Irish origin were conveyed up the Bristol Channel.[23] Breton axes were traded via Cornwall to the Gower Peninsula and the Vale of Glamorgan. By a similar route a class of non-socketed sickles, evolved on the shores of Lake Constance in Switzerland, were brought to Somerset, the Somerset-Gloucester borders, and to Llantwit Major in Glamorgan.[24] This revival of western sea movement was a prelude to full rejuvenation in the Early Iron Age. There is a complete absence of evidence of contact

between Cornwall and Pembrokeshire in the Middle and Late Bronze Ages.

Early Iron Age B culture, introduced into south-western Britain from Brittany and north-western Spain, resulted in the establishment of very different conditions in the Bristol Channel coastlands. All the peaceful aspects of this culture are represented in the lake villages excavated at Glastonbury and Meare, and in addition there are many examples of the multiple rampart hill-fort, a distinctive feature of the military architecture of this phase. In South Wales the existence of this culture has only been proven as far west as the Gower Peninsula by structures in hill-forts (see below) and by pottery and other material recovered. On the north shore of the Severn Estuary the forts at Llanmelin, Sudbrook in Monmouthshire and Lydney in Gloucestershire have proved to have been primary centres of Early Iron Age B (south-western culture). The settlement site on the sand dunes at Merthyr Mawr Warren, Glamorgan—the only evidence of occupation of a non-military character in South Wales at this period—revealed features of life very similar to that of the Glastonbury and Meare lake-villages.[25] Forts with inturned entrances may be safely assumed to constitute a feature of this culture complex, and their distribution along the south coast of Pembrokeshire points to contacts between this area and Cornwall—a flourishing centre of Early Iron Age B culture. On the shores of Cardigan Bay, the hill-fort at Pen Dinas near Aberystwyth yielded sherds of pottery and a spiral-ornamented glass bead—sufficient evidence to prove its occupation by Early Iron Age B folk.[26] The ' duck-stamp ' motif on one of the sherds shows affinities with pottery from the Cornish forts.[27] Since this design has not, as yet, been found elsewhere in South Wales, and is only present in Gloucester east of the Severn,[28] it may be justifiably assumed that the folk who built Pen Dinas came by sea from Cornwall and probably, at the same time, settled in Pembrokeshire. Evidence points to an extension of this movement northwards through the Irish Sea to south-west Scotland.[29] It is thus reasonably certain that Early Iron Age B (south-western culture) contacts were established throughout the coastlands of the Bristol Channel. Further excavation, however, is necessary in south-west Wales to prove conclusively their existence in the western zone.

Although this survey is concerned with cultural contacts in prehistoric times it would be erroneous to give the impression that they ceased with the dawn of the historic period. It has already been noted that the " sub-province of fairly extensive Romanization of the Welsh country-side coincides very closely with the trans-marine province of Iron Age B culture . . .," [30] *i.e.* along the South Wales littoral, and that traces of a Saint's cult in the form of church dedications, common in South Wales, may be found across the Channel in Devon and Cornwall.[31] O. G. S. Crawford [32] suggests that Goidelic influence in Devon in the Dark Ages " may not have come direct from Ireland but from the Irish settlers in south-west Wales." Further examples might be adduced for almost every phase of the historic period up to the present.

The evidence indicates that cultural movements between the Bristol Channel coastlands in prehistoric times were many and complex, for the most part the cultural elements in South Wales reflecting, in varying degrees, those established on the southern shores of the Channel. This complexity was the outcome of the location of the Bristol Channel coastlands in relation to the different routes followed by the major cultural movements into Britain. The two periods when contacts existed throughout the Channel correlate with an extensive use of the western seaways as routes for cultural diffusion. The restricted contacts of the three phases of the Bronze Age fall into a period when the western seaways lapsed in importance and new cultural elements were introduced into south and east Britain and thence diffused by land. During this period even the Irish trade with the Continent was deflected from the western seaways to routes across Britain. In each period a broad division into an eastern and a western zone may be noted. (See Figs. 3, 4 and 5.) Duality and not unity therefore is the major feature of the cultural contacts between the Bristol Channel coastlands, with the reservation that only during periods of western sea movement were contacts established in the western zone. This duality was the outcome of the location of the Bristol Channel—in the west linked with the seaways, at its eastern end adjacent to the Lowland Zone of southern Britain. At all times, however, the Channel acted as a factor linking culturally the south and north coastlands rather than isolating the one from the other and thus promoting their individual development.

[1] Freeman, T. W. "The Early Settlement of Glamorgan." *S.G.M.*, 1936, 52 (*1*) : 12-33.

[2] Freeman, T. W. *Op. cit.*, p. 13.

[3] Defined as a broad belt of country extending from the coast to watershed.

[4] This research in its original form was accepted as a thesis for a higher degree of the University of Wales, June 1947.

[5] Fox, C. "Personality of Britain." Cardiff: National Museum of Wales. 4th ed., 1947.

[6] Forde, C. D. *American Anthropologist*, 1930, pp. 68-70, fig. 25.

[7] Fox, C. *Op. cit.*, p. 43, fig. 19.

[8] A fragment of one of these stones was dredged from the bed of the Bristol Avon.

[9] Fox, C. *Antiquaries' Journal*, 1939, pp. 382-385.

[10] Fox, C. *Op. cit.*, p. 390.

[11] Williams, Audrey. *Archaeologia Cambrensis*, 1941, pp. 26 and 28-29.

[12] Williams, Audrey. *Ibid.*, 1939, pp. 218-219.

[13] Fox, C. *Ibid.*, 1941, pp. 185-189.

[14] Dunning, G. C. *Ibid.*, 1942-43, pp. 179 *sqq.* It is noted (p. 187) that certain features of the construction of the Mynydd Epynt cairn are recorded in two Cornish barrows.

[15] Williams, Audrey. *Proceedings of the Prehistoric Society*, 1940, 6 : 178-189.

[16] Piggott, Stuart. *Ibid.*, 1935, 1 : 115 *sqq.*

[17] Grimes, W. F. *Ibid.*, 1939, 5 : 133. Childe, V. G. "Prehistoric Communities of the British Isles." 1940, p. 44.

[18] Clark, J. G. D. *Antiquity*, 1931: 415-436. Grimes, W. F. *Proceedings of the Prehistoric Society of East Anglia*, 6 : 340-355.

[19] Fox, C. *Archaeological Journal*, 1942 : p. 27.

[20] O'Riordain, S. P. *Proceedings of the Prehistoric Society*, 1946, 12 : p. 157. Also additional information from Professor O'Riordain.

[21] Savory, H. N. *Archaeologia Cambrensis*, 1940, pp. 184-185.

[22] Grimes, W. F. "Guide to the Collection Illustrating the Prehistory of Wales." Cardiff : National Museum of Wales, 1939. Pp. 105-106.

[23] Fox, C. *Antiquaries' Journal*, 1939, pp. 382-383.

[24] Fox, C. *Archaeologia Cambrensis*, 1941, pp. 144 *sqq.*

[25] Fox, C. *Ibid.*, 1927, pp. 44 *sqq.*

[26] Forde, C. D. *Bulletin of the Board of Celtic Studies*. University of Wales, 1933, p. 77 ; 1934, p. 324 ; 1935, p. 378.

[27] Leeds, E. T. *Archaeologia*, 1926-1927, pp. 230-231.

[28] *Transactions of the Bristol and Gloucester Archaeological Society*, 1936, p. 157.

[29] Childe, V. G. "Prehistory of Scotland." Pp. 239 and 242.

[30] Bowen, E. G. *Antiquity*, 1945, p. 178, and maps i. and ii., p. 179.

[31] Bowen, E. G. *Op. cit.*, map iii., p. 179, and map iv., p. 180.

[32] Crawford, O. G. S. *Antiquity*, 1945, p. 209.

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# SOME CHINESE GEOGRAPHICAL WORKS DURING THE WAR

By Ginn-Tze Hsü

Abstract

Yu Kung, the earliest geographical work, is Chinese ; modern geography in China may be considered to have begun after the Revolution of 1911. The progress of geography during the following twenty years was reviewed by Professor Chi-Yun Chang in the *Journal of the Geographical Society of China* (1935, 1936). The present survey [1] of Chinese contributions to geography since 1935 is, roughly, a sequel, though the approach is not quite the same. For convenience, the paper is divided into two parts : the first, accompanied by 48 references, dealing with physical aspects, and the second, referring to 53 publications, with human aspects. A much longer paper, in Chinese, with the same title has been contributed by the author to the above-mentioned periodical. Assistance by C. Y. Wu, H. C. Kuo, and G. C. Dunn is gratefully acknowledged.

## I

*The Geology of China*, by Dr. J. S. Lee, was published in London (1939), and is therefore available to British students. A cognate work is the comprehensive treatise by Dr. T. K. Huang on tectonic forms, which was issued by the National Geological Survey of China

(1945) and is accompanied by a series of maps (1 : 16,000,000). The physical characters and evolution of land forms in the peninsula of Shantung have been described (1941) by P. C. Chow. One of the results of field studies in Sinkiang is a paper by S. Ting on the natural regions of the province. Geological features in connection with highway construction in China were surveyed by the late W. Y. Lin.

The *Soil Geography of China* (1936), by James Thorp, reflects the early work of the Soil Survey directed by the National Geological Survey. The investigations have been carried further by L. C. Chu, Y. C. Ma, and C. K. Lee, almost completing (1940) the 1 : 10,000,000 soil map. Y. C. Ma, also W. Y. Liang, have studied the origin and distribution of loess. Notable provincial soil studies are those by H. Yu and C. K. Lee, of Szechuan, and by Dr. T. Y. Tschau, the director of the Geological and Soil Survey of Fukien ; valuable work by other investigators is also reviewed.

In a brief abstract, only very few of the more outstanding results of geomorphological research can be mentioned, such as on the emerging coast of Fukien, studied by C. S. Kao (1942), and the geomorphology of Kwantung and adjacent regions, by Dr. S. S. Wu and colleagues. Other workers have made notable contributions to knowledge of the rivers and evolution of drainage in China, and C. C. Sun studied the Ching Hai or Kuku Nor basin. Dr. J. S. Lee's work on the Quaternary glaciations in Central China may be considered the Chinese equivalent of Penck and Brückner's *Die Alpen im Eiszeitalter.*

Much progress has been made in climatological research in northern China. Professor John Lee reported on desiccation in NW China (1941) and on precipitation on the Tibetan plateau. In October 1934, Professor Ginn-Tze Hsü established for the Academia Sinica a meteorological station at Lhasa, with valuable practical and theoretical results. Temperatures at high altitudes have also been recorded at Nanking, where Professor C. W. Tu (1940) determined the height of the stratosphere : 18 km. in summer and 11 km. in winter. He and his colleagues also investigated the advance and retreat of the summer monsoon. In a monograph issued (1945) by the National Central University, C. C. Chen gives an account of the duration of frost and of the growing season in China. In addition to the study of the climate of Kweichow, Alfred Lu has been responsible for publications on the climatic divisions of China and for *The Climatological Atlas of China* issued by the National Central Weather Bureau in 1946. Climatic maps on a larger scale, and covering the Far East, have been prepared by the Institute of Meteorology. Of work on regional climatology, that by P. K. Chang, on Szechuan (1941), is quite outstanding.

Biogeography in China is still at an initial stage, but a paper by P. V. Huang on *Regions of Natural Vegetation of China* (1941) augurs well for the future. In a paper published (1944) in the U.S.A., Dr. Hui-Lin Li delimited fourteen phytogeographic regions of China. Dr. K. S. Hao studied the plant geography of the Ching Hai (Kuku Nor) region (1938).

The Land Survey of China has completed a number of map sheets covering several provinces on the scale of 1 : 50,000, and 1 : 25,000 sheets are available for certain areas. The 1 : 100,000 map of Sinkiang must also be noted. A Chinese edition of Sir Aurel Stein's maps has been issued as an atlas by the Department of Geography, National Central University. The National Geological Survey is preparing geological sheets (1 : 1,000,000) for the whole country. A blue-print of the geological map of Szechuan has been completed. Sheets (1 : 200,000) for the entire province of Kwangsi are to be issued in the near future.

## II

One of the pioneers in the development of modern geography in China is Professor Chi-Yun Chang, who is to be congratulated on making the first map of agricultural regions covering the whole Republic, and on account of his other contributions to human geography, notably a paper on *Climate and Man in China* (1946). Under the auspices of the China Institute of Geography, Dr. C. Lin led an expedition to the Kialing Kiang valley, where agriculture, mining, industry, navigation, population, and settlements were studied (1946). On the upper reaches of the same river, S. T. Lee studied the cultural —and climatic—divide between north and south China in the west. Transhumance around Ching Hai was described (1941) by T. Z. Chow.

Considerations of space prevent mention here of much valuable research on settlements, except perhaps a paper by R. S. Chen on the geography of the war-time capital, Chungking (1943).

The highest level of regional geography is reached in the Report on the Geographical Expedition of the Hanchung Basin—in South Shensi—by Professor K. C. Huang, T. C. Wang, E. F. Chen, Y. Y. Hsue, and P. T. Liu, published (1946) by the China Institute of Geography, the establishment of which in 1940, at Pehpei, marks a new era in the advancement of geographical science in China. This 200-page monograph has a companion volume consisting largely of maps. Of other regional studies may be mentioned : *A New Cotton Belt in China*, by Hu Huan-Yong ; *Agricultural Regions of Shansi Province*, by S. D. Chow ; *The Agricultural Regions of Szechuan*, by S. T. Hou.

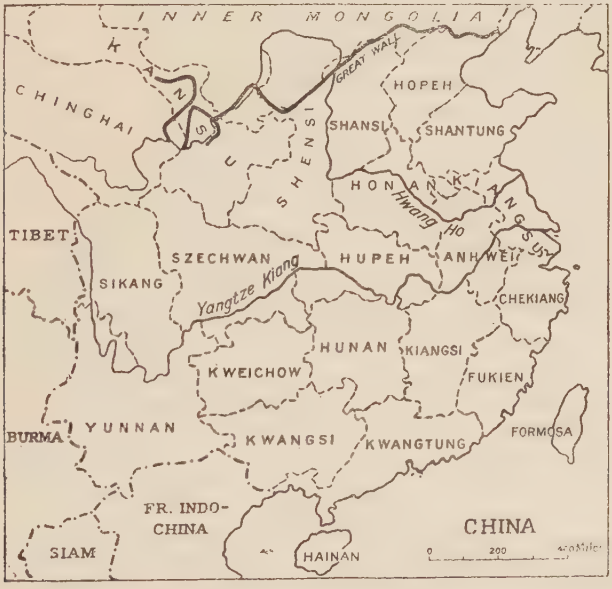
Increasing attention is being paid to the study of land utilisation, as well as to the related problem of soil erosion—a nation-wide menace. Few realised the seriousness of the situation until the author urged Professor T. M. Tieh to draw attention to it in an article which was published in 1941.

A number of good papers on plant and animal products have been contributed by members of the Department of Agricultural Economics of the University of Nanking. Y. K. Tang and T. S. Wei wrote on *The Tea of Fukien* (1941), and C. C. Wang and P. W. Chia on *Tea Production in Tze Yang Hsien, South Shensi*. The silk industry of Nanchung, Szechuan, is the subject of an unpublished thesis by C. Hsieh.

During the period under review there have appeared a number of

notable publications on mineral resources, a considerable amount of work being done by the National Geological Survey and the satellite provincial institutions. A 360-page memoir on *Geology and Tungsten Deposits of Southern Kiangsi* (1943), by K. C. Hsü and I. Ting, is a good example. The antimony resources have been discussed by S. C. Wang, while concise and informative papers on gold have also been published in the *Geological Review*, as those by T. H. Yin on the gold of Kiangsi, S. C. Wang on Hunan, and C. C. Sun on Kansu and Ching Hai. Professor C. Y. Hsieh published a general statement on the minerals of Yunnan, also an account of oil, gas, salt, etc. in the Red Basin, Szechuan. The *Salt Mines of Szechuan* are the subject of a memoir by Y. Y. Lee, and salt production of NW China, that of a report by K. C. Yuan.

Reports (1936-1941) on navigable waterways have been published,




unfortunately without maps, in two massive volumes resulting from a detailed survey by the former Ministry of Economics. The waterways in Szechuan were described in an article (1939) by L. C. Cheng.

The story of the construction of the Yunnan-Burma Highway—more generally known as the Burma Road—is the main theme of a book (New York, 1945) by its chief engineer, Mr. Tan Pei-Ying. The economic value of the Burma Road was discussed in a paper (1938) by T. Y. Yen, who also reported on road investigations on the Ching Hai, Sikang and Yunnan Plateau. Later, he took part in the survey of the road projected between Sichang in Sikang and Sadiya in Assam, and wrote the geographical part of the two-volume Report issued by the Ministry of Communications in 1942, and which will be a classic on the region as well as being a record of one of the most intrepid expeditions in Chinese history. Of other papers on routes may be mentioned : Yunnan, by L. Y. Tsao ; between Ho Shih and southern

Sinkiang, by G. C. Dunn ; between Sinkiang and India, by T. Y. Yen ; between Lanchow and Tahcheng, by K. F. Chung.

Publications on regional economic geography of note are a book on western Yunnan by Professor Y. T. Chang, memoirs by C. C. Wang on SE Szechuan (1944) and on the Chengtu-Chunking Railway now under construction (1945), and a book by C. T. Sung on Taiwan (1946). The Ministry of Education issued (1946) *New China after the War*, dealing with economic and geographical aspects. M. K. Ho, R. S. Chen, and L. Chen have written *An Outline to the Geography of China* (1946), in which the physical background and, more especially, different aspects of economic geography are considered. The first atlas of economic geography is the *Atlas of Kiangsu*, by Professor H. Y. Hu. The *Economical Atlas of Szechuan*, by L. S. Chow, S. T. Hou, and S. K. Chen, was planned by Professor K. C. Huang, and has been issued by The China Institute of Geography (1946). It is well produced and contains 66 maps (1 : 3,000,000) and more than 20 maps on a smaller scale. Bilingual titles for each map are given in an explanatory companion volume.

A book on the history of the Chinese canals, by Professor N. H. Shih, represents perhaps the first noteworthy work on historical geography in China.

*The Political Geography of China* (1947), by W. P. Wang, is an interesting book, in which the author indicates that the north west was of supreme importance in the continental age, the south-eastern coastal part of the country in the oceanic age, and NE China in the air age. The first study of the development and significance of names of political regions and places is by T. M. Chin, whose paper (1943) is accompanied by a German summary. Professor H. Y. Hu, noted for his work on demographic geography, has written a memoir on a *Plan for Redivision of Chinese Provinces*, based on a series of twelve maps (1 : 500,000) showing population density, cultivated land, land taxes in each hsien (county), in addition to topography, mineral resources, etc. The redivision increases the number of provinces and territories from thirty, as at present, to sixty-six, the name of each new province being coined critically. So far, this is the only geographical work to have been awarded a prize by the government.

[1] In response to a suggestion made to him by the President of the Royal Scottish Geographical Society, the author, who is Professor of Geography at the National Central University, Nanking, and a graduate (Ph.D.) of the University of Edinburgh, very kindly contributed the paper which is briefly summarised above.

The original manuscript and a typed copy, including the bibliography, are deposited in the Society's Library. Members will be grateful to Professor Ginn-Tze Hsü for having prepared this valuable and, to a considerable extent, otherwise inaccessible information, and also for providing them with an indication of the high quality of constructive work undauntedly carried on in his great country during a long period of tribulation.—Ed.

# REVIEWS OF BOOKS

## EUROPE

*The Land of Britain, its Use and Misuse.* By L. Dudley Stamp, C.B.E., B.A., D.Sc., A.K.C., Hon.M.T.P.I. 11×8½. Pp. viii+507. 237 figs. London: Longmans, Green and Co. Ltd., and Geographical Publications Ltd., 1948. 42*s*.

It is difficult to exaggerate the value of the maps and reports produced by the Land Utilisation Survey of Britain, not only to students of geography but also to those concerned with town and country planning and with war-time agricultural developments. In this book the history of the work of the Survey is recorded, and its results are summarised and examined.

The distribution of each class of land use is studied together with the particular characteristics of the land suitable for that use. In this connection, it is interesting to see published for the first time the Reconnaissance Survey of the Vegetation of Scotland, prepared from the work of Marcel Hardy and others by Dr. Arthur Geddes and Dr. Stamp. It will be remembered that this map was the subject of a discussion meeting of the Society which was reported in a previous issue of this *Magazine.*

The factors influencing land use are discussed, and Dr. Stamp points out that, with increasing specialisation and improved transport, physical factors have exerted an increasing influence on the determination of land use. This fact is well shown in an interesting series of maps, which show by a dot method the way in which the emphasis on different crops has altered between 1874 and 1938.

From this the book goes on to analyse the land use pattern, and gives accounts of the maps of Types of Farming and Land Classification, also produced by the Land Utilisation Survey. In conclusion, Dr. Stamp studies the question of Land Use Planning and enunciates valuable principles by which decisions between conflicting uses of land may be made. In particular, he emphasises that where a change of use, such as that from farming to housing, is contemplated, the onus of proof of the necessity for the change must lie with the new user. This principle is of primary importance, when so much of our valuable agricultural land is in danger of being used for housing because it is in the short term cheaper to build on.

The book is effectively illustrated with maps and diagrams. The maps of the distribution of the different types of use over the whole country are effective, though the same technique when applied to counties alone is not so satisfactory, owing to the lack of topographic detail. Numerous reproductions of sections of the Survey's six-inch field sheets give typical examples of the various types of use. Summary tables give the statistical results of the Survey's work on a county basis. In a necessary book for anyone concerned with the broader aspects of land utilisation it seems a little out of place to include the detailed administrative history of the Land Utilisation Survey. The account of the methods is, however, valuable and necessary.

J. B. F.

*Vision of Scotland.* By G. S. Fraser. Preface by The Rt. Hon. Thomas Johnston. 9½×7. Pp. 180. Drawings by Barbara Jones. 167 photographs. 2 maps. London: Paul Elek (Publishers) Ltd., 1948. 25*s*.

In his *Vision of Scotland* Mr. Fraser divides the country into six parts: The Borders and Galloway; Edinburgh; Glasgow; the North East; the Highlands; the Islands. The author describes Scotland from an individual angle and has much to say that is new and stimulating in these charming essays. He is perhaps at his best when writing of the Highlands and Islands, but gives a somewhat too sombre picture of Glasgow—"the great melting pot of the Scottish race"—which is not all slums and frustration, as indeed Mr. Fraser concedes. The reader is grateful to him for many unhackneyed quotations, especially Alexander Smith's fine poem on Glasgow.

Miss Barbara Jones contributes some interesting drawings of unusual subjects, such as the shell garden at Leven, and the photographs, which are very good indeed, are descriptive of Scotland where words fail for lack of space. There is an excellent map.

I. W. H.

*Heklugos, 1947-1948.* By Gudmundur Einarsson. Abbreviated English version by Bjarni Gudmundsson. 9½×7½. Pp. 184. Coloured frontispiece. 64 photographs. Reykjavík : Gudjon O. Gudjónsson Forlag, 1948. Copenhagen : Rosenkilde og Bagger. *Kr.* 37.50.

In the English text this work is stated to be the second edition, the first having been published in 1947. It brings the story of the great 1947-48 eruption of Hekla up to date. An account of the eruption has recently been published by the reviewer [*Nature*, 1948, 161 (*4080*) : 41-42], mainly from data collected by the engineer-geologist Trausti Einarsson. The present book is divided into four parts : first, a geographical and historical section, then the 64 magnificent plates, a long way the most valuable part of the book for the volcanologist. This is followed by the English version—seventeen pages—which is mostly an entertaining narrative of the eruption, and of the hazardous visits to the volcano by mountaineers and geologists—the Director of the State Board of Scientific Research was unhappily killed by a falling block of lava. Finally, there is the narrative, in Icelandic, of the present eruption.

Except for the plates and a few graphic descriptive touches there is little of scientific interest in the book, but as a popular account of a magnificent and terrifying spectacle it will be hard to beat. G. W. T.

*Forestry in Denmark : A Guide to our Guests.* By Axel S. Sabroe. 9½×6½. Pp. 114. 11 figs. 17 photographs. Bibliography. Copenhagen : The Danish Forest Society. Second edition, 1947.

This admirable publication, in excellent English and faultless print, gives a view of forestry activities in Denmark. After dealing with geography, soil and climate, illustrated with several good maps, the author deals with legislation, statistics, the trees grown, methods of treatment, regeneration, thinning, marketing, labour, management—in fact nothing is omitted that any enquiring visitor could possibly want to know. There is an extensive bibliography and also a Who's Who of forest officers and others connected with forestry in Denmark.

Of the many interesting aspects of forestry mentioned, one may cite the use of Scots pine to fix blown sand, the excellent results obtained from the Norway spruce (*Picea abies* L.=*P. excelsa* Lk.) which now covers one-fourth of the acreage of the old woodland and much of the heathland, the heavy incidence of fungus disease due to the damp climate, and the absence of rabbits—it is stated that rabbits are practically confined to some small islands !

Like other countries, Denmark suffered from heavy fellings during the two wars. During the occupation, by a dilatory policy and other means, the Danish foresters blocked the large German demands to some extent, so that the Germans hardly managed to get more than 200,000 cubic metres for their fortifications and tank traps.

The publication contains excellent graphs and tables, and is obviously not only a guide to visitors, but a volume for the specialist and the student. W. B.

*The Scented Isle : A Parallel between Corsica and the Scottish Highlands.* By Joseph Chiari. 7¼×4¾. Pp. 118. 24 illustrations. Glasgow : William Maclellan, n.d. 7*s* 6*d*.

In this very readable and well illustrated little book the author quotes from a letter written in 1794 by Sir Gilbert Elliot, for a short time British Governor of " the Scented Isle " : Corsica " is like Scotland with a fine climate." And the parallel is worked out by a brief study of the national characteristics, of the social institutions and the history of the two regions.

The sections on Scotland may, perhaps, be coloured by a slight romantic haze due to the pink spectacles of the friendly critic, but the British reader will certainly find much that is fresh and interesting in the chapters dealing with the chequered history and the present state of Corsica, and with the freedom-loving folk who dwell therein : a people of legendary hospitality, abstemious and strict in their morals, otherwise easy-going in their ways, but always troublesome to the invader, and who, even in this age of tourism, have not yet wholly abandoned the archaic modes of existence that first attracted the attention of the curious traveller.

R. T. C.

## ASIA

*Le Monde Malais.* By CHARLES ROBEQUAIN. $8\frac{3}{4} \times 5\frac{1}{2}$. Pp. 510. 32 sketch maps. 32 photographs. Paris : Payot, 1946. 440 *fr.*

The Malay world here described includes the Malay Peninsula, Sumatra, Java, Borneo, Celebes, the Moluccas and Philippines. It is the work of an eminent French geographer who has made an exhaustive study of the region and has the advantage of personal knowledge. It is a most comprehensive and scholarly work and is divided into five sections. The first is an able general introduction which includes a fascinating account of the historical background. Section two discusses in great detail the relief, climate, vegetation, population and industries of each region in turn. The third part treats of economic development. Next, the sociological history receives interesting treatment as this is a subject in which the author is particularly interested. The final section deals with the effect of the Japanese occupation and the present-day problems which have resulted.

There is a comprehensive bibliography. The sketch maps and photographs are disappointing and the production compares unfavourably with British standards. The book is, however, full of information and will prove of value to all students of geography. J. A.

*The New Malaya and You.* By H. B. EGMONT HAKE. $7\frac{1}{4} \times 5$. Pp. 107. 16 illustrations. 3 sketch maps. London : Lindsay Drummond Ltd., 1945. Paper board, 6*s.* Cloth, 7*s* 6*d.*

This small book is a pleasant introduction to Malaya for the general reader. The author, long resident in the country, gives a brief account of British Malaya, Japanese Malaya and the New Malaya. He discusses the present situation and argues that the New Malaya must be based on a thorough understanding of the problems now awaiting solution. The illustrations are excellent. J. A.

*Malaya : Outline of a Colony.* By VICTOR PURCELL. $7\frac{1}{4} \times 5$. Pp. vii+151. 11 illustrations. 2 sketch maps. London : Thomas Nelson and Sons Ltd., 1946. 6*s.*

The author of this book writes with an intimate knowledge of his subject. His descriptions of the country, his portraits of its peoples, his account of its long history and of its modern development are painted in masterly style. Industry and commerce are reviewed and finally there is a summing up of the progress which British administration has brought to Malaya. This book succeeds in giving an excellent and comprehensive picture of Malaya in small compass. J. A.

*Malayan Landscape.* By KATHARINE SIM. Introduction by Sir Richard Winstedt, K.B.E., C.M.G. $8\frac{3}{4} \times 5\frac{5}{8}$. Pp. 248. 19 illustrations. End-paper sketch maps. London : Michael Joseph Ltd., 1946. 15*s.*

This is a description of Malayan life as experienced by the wife of an English custom's official. She gives an intimate account of domestic routine and of the happy relationship with those with whom she came in contact. While a book of no geographical value, it is charmingly written and attractively produced. J. A.

*China.* By NEVILLE WHYMANT. $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 121. End-paper sketch map. Citizens of the World Series, No. 2. London : St. Botolph Publishing Co. Ltd., 1946. 5*s.*

Anyone wishing to make acquaintance with the long and colourful history of China could not do better than read this compact little book written by one who has a keen sympathy with, and an understanding of, the people and their problems. Its pages are full of facts, supported by figures. The chapters on History and on the Country and its People will interest the majority of readers, and at the same time their knowledge of that great land and its people will be greatly enhanced. But there are also those who will be interested in the working out of modern conditions as portrayed here. Civil war, the bane of China, is being waged at the present time, but those who know China best have faith in her resurgence. A. C.

## GENERAL

*The Earth's Face : Landscape in its Relation to the Health of the Soil.* By EHRENFRIED PFEIFFER, M.D.(HON.). Foreword by Sir R. George Stapledon. $8\frac{3}{4}\times5\frac{1}{2}$. Pp. 138. 60 illustrations. London : Faber and Faber Ltd., 1947. 12*s* 6*d*.

In the words of the author, " this book attempts to picture the conditions in our environment which lead to the maintenance or loss of the fertility of the earth's surface, and it refers these conditions to their true source, whether a natural evolutionary process or artificial human intervention." In some respects the author goes further. Environment includes the landscape in its varied forms. Each has its characteristics and uses for man, and each may show clear symptoms of health or disease as a result of human action. But while man may modify the landscape well or ill, he in turn is profoundly affected by it. The author takes pains to show how in the country and especially in the town man must, for his own sake, follow sound biological principles or suffer economically, physically, spiritually, and mentally.

It is the systematic development of this theme, the completion of the chain between soil and man, far beyond the ordinary treatise on soil abuse, that imparts merit to the book. It should make special appeal to the wide audience of those who, though not workers on the land, have the philosophic insight and power of reflection to appreciate the importance of the problem.

The photographs are of special merit and by themselves worthily convey the spirit and aims of this delightful book. R. M. C.

*Men, Machines and History : A Short History of Tools and Machines in Relation to Social Progress.* By S. LILLEY. $7\frac{1}{4}\times4\frac{3}{4}$. Pp. viii+240. 52 illustrations. Past and Present, Vol. 7. London : Cobbett Press Ltd., 1948. 10*s* 6*d*.

Man is a tool-making animal, and a history of the tools invented by man is a history of man from his beginning. But what a task for any one man to attempt, to make a record of the tools invented and developed by his forefathers during the past five thousand years or more. Yet this is what Dr. Lilley has done, and done with a remarkable degree of success. In this history of the tools and machines invented in each age we can read the evolution of mankind from its earliest beginning to the present mechanical age.

This is not a book for the mechanic or the specialist. Where so much has to be covered, detailed description is naturally impossible. It is a book for the philosopher and the student of human geography. For since necessity is the mother of invention, it is man's necessity to adapt himself to various geographical environments which has prompted his inventions, his tools, and his machines. In this respect Dr. Lilley's book may well be called " Men, Machines, History and Geography." R. R. W.

*Farming for Industry.* By R. O. WHYTE. $7\frac{1}{2}\times5$. Pp. 160. 26 illustrations. Todd Reference Library. London : Todd Publishing Group Ltd., 1948. 7*s* 6*d*.

It is difficult to know for what public this book was written. For the general reader it does not tell enough about anything, while the specialist will find little new in it. Perhaps the task of compressing within 160 pages a discussion of most of the crops grown for industrial purposes is too much for any writer, however gifted.

The author assumes rather too much knowledge on the part of his readers, if these are the lay public. For example, warble fly and boll weevil are mentioned casually, as if there were nothing to explain as to why they are pests and the type of damage they do. In the chapter on natural plant fibres, there is an almost complete lack of information—beyond a few figures—concerning cotton in India, though that country is second in the world in output. An excessive amount of space is given to the two freak rubber crops, kok-saghyz and guayule. Some of the real difficulties in tobacco-growing, such as the Orobanche parasite, are not mentioned.

The illustrations are scattered through the book, mostly away from the text they are intended to illustrate, and some of them help the reader very little, such as the photograph showing a groundnut plant, which is a picture of a few leaves. The sources of statistics are, as a rule, not indicated. W. B.

*City, Region and Regionalism : A Geographical Contribution to Human Ecology.* By ROBERT E. DICKINSON. 8½×5½. Pp. xv+327. 75 figs. International Library of Sociology and Social Reconstruction, edited by Karl Mannheim. London : Kegan Paul, Trench, Trubner and Co. Ltd., 1947. 21*s.*

Ripened by foresight, this is a book for the times. From the study of the city as the core of its region, it proceeds to that of the city itself and its own quarters or " sub-regions," then to that of the region actually commanded and served by a given city. It concludes with a review of the regional movement and its significance, from regional, through national, to international aspects. Principle and example, theory and facts, are well balanced. The illustrations by map and plan are pertinent and revealing by the comparisons and contrasts they present. The work is genuinely geographical in method by its disciplined use of " scale " from unit to group, from place to region. It is geographical in philosophy, in seeking to discover where opportunity has led to utilisation, yet where opportunity has been lost by wasted resource and by competitive, or merely blind or arbitrary, exploitation.

A common criticism of " planning " is that every plan falls out of date. Such a work as this illustrates how dynamic surveys of changing locations, by recognising trends, may recognise their cause and so forecast and provide for opportunity.

A. G.

*Boundary-Making : A Handbook for Statesmen, Treaty Editors and Boundary Commissioners.* By STEPHEN B. JONES. Foreword by S. Whittemore Boggs. 9½×6½. Pp. xv+268. 26 maps and diagrams. Washington, D.C. : Carnegie Endowment for International Peace, Division of International Law, Monograph No. 8. New York : Columbia University Press, 1945. $3.00.

Professor Jones has compiled a handbook for boundary makers rather than a critical examination of boundaries. Many examples are cited in order to illustrate the merits and defects of boundaries, but some well-known examples are ignored. The Canada-Labrador boundary dispute, though it illustrates the confusion due to lack of definition, is not noted, but the Canada-Alaska " Panhandle " dispute of an earlier date is discussed. We would like also to have seen an exposition of the sector principle of sovereignty as used in the polar regions. The book, however, is an excellent scholarly work and is fully documented. R. N. R. B.

## D'ARCY THOMPSON COMMEMORATION FUND

A fund to commemorate the late Sir D'Arcy Thompson has been opened in St. Andrews. It is hoped that this appeal for a worthy memorial to our late President will meet with a cordial response from members of the Royal Scottish Geographical Society.

Subscriptions should be sent to the Treasurer of the D'Arcy Thompson Commemoration Fund, Royal Bank of Scotland, St. Andrews, Fife.

## ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

### PROCEEDINGS

MEETINGS OF COUNCIL were held on 11th January and 1st March 1949.

*Obituary.*—The Council wish to record the sense of loss the Society has sustained by the death of :

Miss ISABELLA ROBERTSON CHRISTIE, F.R.S.G.S., Member of the Society for 44 years, Fellow since 1911, energetic and valued member of Council, and Vice-President since 1934. Miss Christie was a noted and intrepid traveller whose interest in the Society and the younger generation was outstanding.

Sir THOMAS B. WHITSON, LL.D., C.A., who gave valued service to the Society as Treasurer for over twenty years.

Sir IAIN COLQUHOUN, BT., K.T., D.S.O., a Vice-President of the Society, whose devoted work for Scotland was the hall-mark of his life.

*Mungo Park Medal.*—The Society's Mungo Park Medal was awarded to Mrs. MARY G. HENRY, of Gladwyne, Pennsylvania, U.S.A., in recognition of her contribution to geographical knowledge by her explorations of northern British Columbia in 1931 to 1935.

*Research Medal.*—The Society's Research Medal was awarded to Professor ALEXANDER STEVENS, M.A., B.SC., University of Glasgow, for his published contributions to geographical science and particularly to the geography of Scotland, and for his promotion of studies by others.

## SPECIAL LECTURE

A joint special Meeting of the Royal Society of Edinburgh and the Royal Scottish Geographical Society was held in the Central Hall, Tollcross, Edinburgh, on Monday, 28th February 1949, at 4.30 p.m., when, at the request of the two Councils, Professor HANS PETTERSSON, HON. F.R.S.E., of Gothenburg, addressed the Societies on the recent Swedish Deep-Sea Expedition.

## TECHNICAL PAPERS * AND DISCUSSIONS

These Papers and Discussions proved of great value and were most successful.

| | | *The Society's Rooms, Synod Hall* |
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| | 1948 | |
| *5 p.m. | Oct. 22nd | E. WYLLIE FENTON, M.A., D.SC., on "An Outline of Vegetation Changes with Human Implications." |
| 7.30 p.m. | Nov. 12th | C. J. ROBERTSON, M.A., PH.D., on "East and West in Europe." |
| *5 p.m. | Nov. 26th | Mrs. JEAN PETRIE, M.A., and G. A. CUMMING, M.A., PH.D., on "The Use of Air Photographs." |
| 7.30 p.m. | Dec. 10th | R. MILLER, M.A., PH.D., on "Britain and the Colonies." |
| *5 p.m. | Dec. 14th | H. J. FLEURE, D.SC., F.R.S., on "Switzerland and its Relation to Problems of Federation." |
| | 1949 | |
| *7.30 p.m. | Jan. 21st | Dr. E. J. LINDGREN-UTSI, on "Contemporary Reindeer Breeding." |
| *5 p.m. | Jan. 28th | W. B. FISHER, PH.D., on "A Monsoonal Effect in the Mediterranean." |
| 7.30 p.m. | Feb. 11th | ARTHUR GEDDES, D. ÈS L., PH.D., on "India and Pakistan." |
| *5 p.m. | Feb. 25th | Sir FRANK MEARS, P.R.S.A., on "Planning: Central and SE Scotland." Part I. |
| 7.30 p.m. | Mar. 11th | D. RONALD MACGREGOR, M.A., on "Whither Caledonia?" |
| *5 p.m. | Mar. 25th | Sir FRANK MEARS, P.R.S.A., on "Planning: Central and SE Scotland." Part II. |
| *5 p.m. | April 8th | Miss PEGGIE HOBSON, B.SC., on "Is Crofting becoming Obsolete?" |

## ERRATA

*S.G.M.*, Vol. 64, No. 3, page 172, line 36. *Should read:* February 2nd, Peter H. Davis, on "In South West Anatolia." Illustrated.

Page 172, line 50. *Should read:* Miss Peggie Hobson.

## NEWBIGIN PRIZE: 1949 AWARD

A Bronze Medal and Money Prize will be awarded for the best Essay, suitable for publication in *The Scottish Geographical Magazine* and not exceeding 7000 words in length, on any subject relating to the geography of Scotland.

Essays, typed and with any illustrations prepared for reproduction, in envelopes marked "Newbigin Prize," must be lodged with the Secretary, Royal Scottish Geographical Society, Synod Hall, Edinburgh 1, on or before October 31st, 1949.